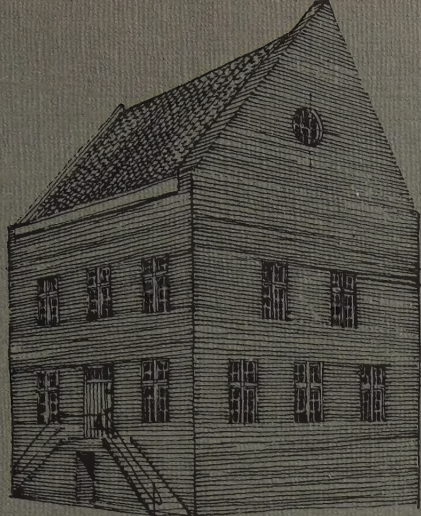
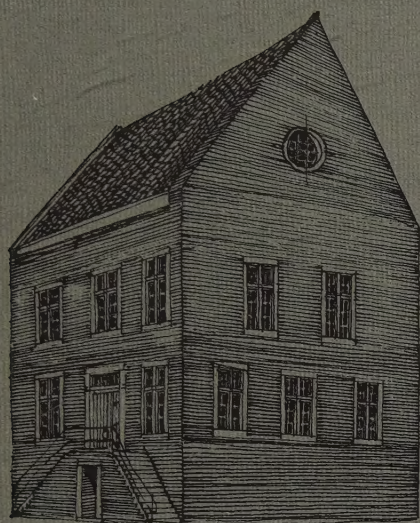


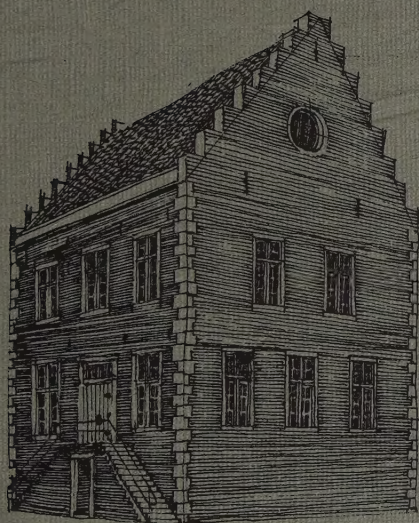


LOOKING at BUILDINGS

Individual Variations
in the Perception of
Building Exteriors



Jan Janssens



DEPARTMENT OF THEORETICAL AND APPLIED AESTHETICS
SCHOOL OF ARCHITECTURE
THE LUND INSTITUTE OF TECHNOLOGY

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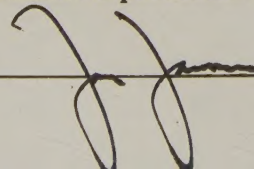
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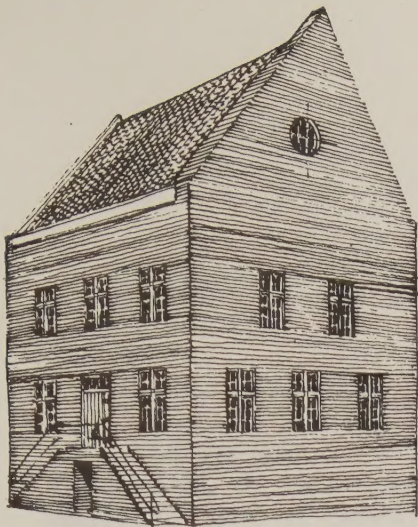
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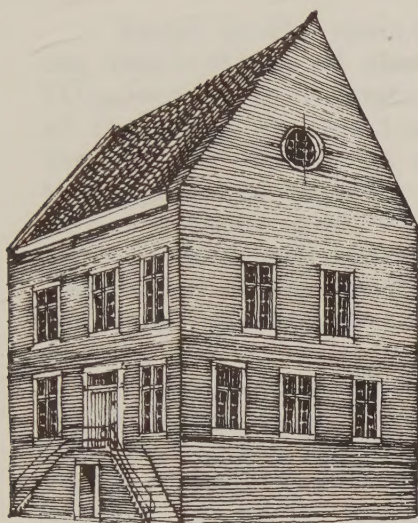
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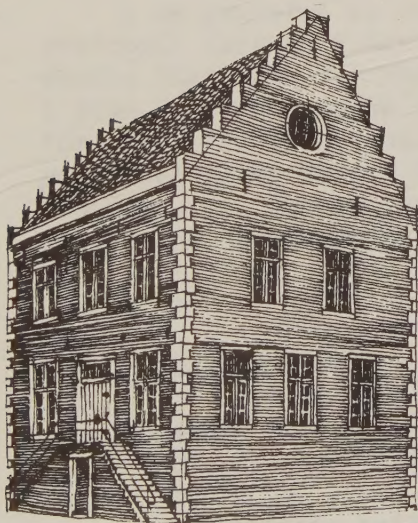


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PREFACE

The present work tries to contribute to our knowledge concerning an important problem in modern architecture: the apparent lack of correlation between the built environment's technical, economic and functional aspects and its aesthetic and emotional properties.

Based on the results of three empirical investigations, the implications of some effects of this evolution are illuminated. An introductory description of the background of the study and its topics is followed by an outline of the theoretical frameworks supporting it. The three studies are then presented together with an explanation of the experimental methods used. Finally there is a discussion of the results obtained, together with notions on the general importance of the findings and suggestions for their practical applications.

The empirical studies have been partly supported by grants from the National Swedish Building Research. They have previously been published in Swedish in three extensive reports (Janssens, 1976, 1981, 1984). The work has been carried out at the Department of Theoretical and Applied Aesthetics at the School of Architecture, Lund Institute of Technology.

I am grateful to the previous head of the department, professor Carl-Axel Acking and the present head, professor Harald Thafvelin for the received facilities and support. I also wish to express my thanks to my friends at the school for their invaluable help, making the completion of the work possible; James Watzke for his assistance with the English language, dr. Gunnar Jarle Sorte and my tutor dr. Rikard Kuller and not least my 'allt-i-allo' Inger.

Lund, September 1984

Jan Janssens

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ABSTRACT

Based on three empirical studies, the effects of the built environment's architectonic expressiveness on individual observers was assessed. Local everyday building exteriors, presented either in reality or as color slides, were described by the experimental subjects' semantic ratings, verbal reports, and eye movement registrations.

In the first study, focusing on the exteriors' potential for expressing their factual functions, all three methods were highly related to each other. Analysis of the subjects' eye movements provided relevant information on specific building parts' visual attraction value. No straight relationship between perceived pleasantness and ease of identification could be shown.

In the second study several of the observers' personal measures were related to their perception of built environment. By means of self-report methods, the subjects were assessed in 19 personal dimensions. Most of these affected some of the environmental experiences.

In the third and synthesizing study professional discrepancies in perception of building exteriors were examined. Experienced architects were compared to academic laymen for both personal measures and environmental evaluations. Only minor explainable differences between the groups were demonstrated.

The findings gave valuable information for the improvement of the visual built environment and for the understanding of individual differences in environmental perception.

chapter 1: Introduction

BACKGROUND

The most outstanding shortcoming of the last four or five decades of architecture might be its poverty of expression and lack in variation. Much of our modern built environment satisfies only the primary needs of good architecture: shelter from the climate and privacy for the individual. The more sophisticated needs e.g., richness in variation and scale, intelligibility, expressiveness and beauty are all too seldom considered. To some degree these shortcomings depend on factors outside the architectural field. Eager to accomplish the governmental promoted 'one million program' (one million new dwellings to be built in Sweden in less than 20 years) planners and decision makers pushed the merely functional and economic aspects of buildings and city plans.

There is not much scientific work needed to reveal most people's negative evaluations of such environments (Kuller, 1972). Complaints about more or less severe shortcomings in the visual environment are becoming more customary. In the daily media, both experts and laymen often report their discomfort and demand that action be taken.

Like any other segment of modern society, architecture has been affected by the rapid industrial development with all its benefits and drawbacks. The individual's ability to take part in and understand the isolated processes are put to a hard test.

Technocratic arguments for a rational building production mostly involve the manufacturing of many identical or similar massproduced building elements of considerable sizes, together with a fast mounting procedure. Every kind of deviation or variation delays and increases the costs in this rational production. Even if a certain flexibility can be incorporated into the process, for instance by the use of optional facade colors, the biggest stumbling-block still appears to be the philosophy of the large system itself.



The more recent technical evolution in heating insulation has also demonstrated its drawbacks for the appearance of the built environment. Many previously lavishly outfitted exteriors have been coated by layers of insulation and then covered by simple, unstructured, easy to maintain surfaces in artificial materials.

Likewise, developments within the architectural field itself were not all that favourable. Apart from the benefits it introduced into architecture, the Functionalistic style had one severe drawback. Its austere and consequent theory was expressed by an equally straight, plain and geometrical formal language, thus denying much of the previously appreciated decorative and differentiating building values.

Although the situation described above is based on Swedish conditions, it seems reasonable to assume the state of the art in other parts of the world is plagued by similar shortcomings. Modern industrialized countries in the western world seem to demonstrate an astonishing uniform architectural development, especially with regard to mass housing production. Suburban districts in South America or Africa for instance, are often visually similar to suburbs in northern Europe.

Asked for their environmental preferences, people often name untouched natural sceneries or older built environments. Much of the old historical building art and town planning thus appeals to them. Many of the modern examples of noteriety apparently have clear formal roots in older, often medieval architecture. When people travel on holiday to new places one may wonder if they even notice the visual appearance of the local modern architecture. It seems important to question whether the uninitiated laymen appreciates or even notices the aesthetic qualities of everyday modern architecture.

We do not know if there was a greater appreciation of architecture in the former days. There is however no obvious reason why today's architecture should not appeal to and affect people in a more positive way. Ideally, the art of building might become a source of joy and even contribute to the harmonic development of society and its individuals.

THE PROBLEM IN GENERAL

The object for the present work is, in quite general terms, to gather knowledge in order to achieve a better and more humane built environment. In more detail, it is studied how the architecturally expressed meaning of the built environment affects the observer. In other words, how does the understanding of the semantic information, supplied by architectural structures, affect the individual's emotive perception of these objects. It is also studied how this information, composed of a variety of messages and communicated by different means, is adapted and interpreted somewhat differently by each individual.

Since the more abstract phenomena in the art of building are hard to describe in scientific terms, architectural research often tends to focus on technical and functional aspects. Partly as a Functionalistic heritage, aesthetic and emotional qualities have seldom been familiar to general constructors, managers and decision makers. One of the main reasons for this might be the large variation in preference between individuals. However, increasing discomfort with the visual appearance of modern architecture is reported by a large public (Acking, 1972, Rapoport & Kantor, 1967). Even if particular modern buildings or environments are evaluated highly by experts for some aspects, the general laity sometimes has difficulty in seeing and appreciating these qualities.

Although its importance has never been questioned within the architectural field, the concept of meaning is constantly under discussion. The literature on the subject is quite extensive and continuously increasing (Norberg-Schulz, 1965, Hesselgren, 1969, Prak, 1968, Rapoport, 1982). Many scholars try to place their arguments on a broader philosophical base. A number of theoretical frameworks developed within other disciplines might be helpful for the understanding of architectural meaning, for example, semiology and information theory. These theories not only elucidate the quantity of communicated information, but also attempt to explain the quality of such communication. It has been shown that, at least for built environments, this type of information will be interpreted uniquely by each individual observer, dependent on his background, personality or even mood (Mehrabian & Russell, 1974).

The mentioned discrepancies in perceptual experiences have also been studied in other fields, especially within the arts (Buswell, 1935, Berlyne, 1974, Sandström, 1979) and the importance of individual traits as explanatory factors for differences in experiences has been clearly demonstrated. However, the exact connections between specific traits and isolated experiences need to be further illuminated.

In the work presented here, it is assumed that buildings are important communicative elements in the everyday surrounding of modern man. They constitute significant objects for scientific investigations on communication between humans and their physical environment. An attempt is also made to elucidate the importance of individual and professional characteristics for the perception of the built environment.

It is also assumed that the reading of the architectural messages will affect the experiencing of the medium, the signbearer, or in this case, the buildings. Even if the observer does not understand the meaning of the communicated messages, they will affect his perception of them and their physical context. Here, the observer's factual knowledge about the architectural medium might be of considerable importance. Experts, through their training, should be more accustomed to the terminology within their own field, thus facilitating the reading of specific messages.

Evidently many variables interact in this reading of messages, but in the present work a few principal ones were selected in order to discover any relationships between the observers' notions of relevant physical building parts or details and their emotional evaluations. Essentially two sets of variables emanating from the field of environmental psychology were used, one describing the observers, one the observed. By relating the two, it was hoped that the above connections could be clarified and thus made available for the practical designing situation.

It is important to stress the fact that the aim here has not been to present foundations for a new architectural theory, but to throw light on some aspects that might be of interest for the understanding of the architectural experience. As Norberg-Schulz indicated in his 'Intentions in Architecture' (1965) there are essential differences between these two goals. Theory and experience can not replace each other, but both together can give insight into the essence of architecture and how the art of building affects the human history and development.

A THEORETICAL FRAMEWORK

What follows is a brief summary of three theoretical perspectives which best explain the theoretical context for the present work. It should be understood that the nature of these investigations is very experimental, relative to much of the research done previously on these kinds of architectural questions. Nevertheless, the theories that follow have been fundamental sources for the generation of ideas, categorization of the problems and selection of the variables to be studied. Where relevant, the results of the experiments will also be interpreted in terms of this theoretical framework.

Semiotics

C.W. Morris (1938) introduced a conceptual apparatus in which thoughts on communication flows were presented. In his theory of signs, semiotics, he described the semiosis-process as existing of four factors, which translated to the field of architecture can be interpreted as: signbearer or the building acting as a sign; designatum or what the sign is referring to; interpreter or the user or observer of the building in question; and interpretant or the effect of the sign on the interpreter.

The relations amongst these factors can be described in at least three dimensions: semantically, between sign and object or building; pragmatically, between sign and interpreter; and syntactically, between signs mutually. All these dimensions interact in the communicative process and are of primary interest for the basic architectural research.

For the present work, semiotics provided the structural organization for the outlining of the experiments which follow, i.e. categorization and labelling of the factors to be studied in the series of experiments. Each of the three experiments can be summarized in terms of semiotic factors.

Study I focuses primarily on the signbearer's role in the process, i.e., the building's potential to express certain messages.

Study II focuses mainly on the interpreter's abilities to read and understand, experience and evaluate the environmental messages.

Study III, inspects the process as a whole, incorporating the influences of the interpreter's knowledge of the messages imposed by training.

Information Theory

One scientific theory of interest for the study of communications between people and their environment is information theory. In 1966 A. Moles wrote his 'Information Theory and Esthetic Perception' and applied the original theory, based on technical communication systems, to human perception. The most important conclusion of this theory was the partition of all communication into redundancy and message parts. Redundancy consists of information already known to the receptor, while message is the new and before unknown information. Communication, existing only of redundancy thus becomes uninteresting while communication existing only of messages becomes too complex and incomprehensible. A message, to be communicated adequately, still has to be put in a proper context in terms of redundancy.

Another of Moles' contributions was that he discerned two different types of information. First there is semantic information with a universal logical structure and translatable into other language systems, in architecture for instance the concept of supporting or being supported. Second there is aesthetic information, referring to evaluations and thus not logical or translatable, for instance, the concepts of beauty and ugliness. For works of art, like architectural objects, it is the aesthetic information that stimulates new discoveries and gives new impulses, involving and partly depending on the individual observer's mood. Semantic information, on the contrary, just requires some training to be totally exposed and therefore becomes uninteresting.

Information theory's occupation with 'rate of information' is of special interest for the present work. Information rate is believed to be related to the concept of complexity (Berlyne, 1967, Mehrabian & Russell, 1974). The ideas and measurements of complexity are used in the present studies, both in the selection of the experimental stimuli (the building exteriors) and as an important variable in the explanation of people's evaluations of the built environment.

Activation Theory

Human behavior is grounded on and affected by an immense number of aspects and every investigation can therefore only illustrate a few of these. It is thus necessary to place every investigated aspect into a larger context, mostly by means of theoretical models. This must be done in order to retain the general overview and also to help realize the limitations and restrictions of the aspects studied in each separate case.

A theoretical interactive model which stipulates several relations between people and their environment was developed by Kuller (1976). The factors affecting individuals are according to this model: the built environment itself, the individual's social environment, the individual's personality and the ongoing activity pattern, together with different types of recurrent variations, like the diurnal rhythm.

The central part of the model, the individual's basic emotional process, implies four steps: activation, orientation, evaluation and control. Since the individual normally strives to keep emotional control in the given situation, psychological and physical disturbances in the process will lead to different types of adaptation or compensation. Factors which benefit this basic emotional process also facilitate the adaptation and lead generally to a more open attitude, which helps to prevent mental problems and social isolation. The model stipulates rather strong connections between the different factors, for instance between housing facilities, work and use of leisure, which means that experiences in one sector can affect experiences in the other sectors (Kuller, 1979).

Three of the four factors in Kuller's model, the individual's personality, the social situation and the built environment, are linked to the experiments conducted in this work. Most of the experimental variables were selected in an attempt to investigate the connections between these factors. Furthermore, the model's focus on the individual's basic emotional process was felt to be theoretically related to the experimental subjects' assessments or experiences of the built environments studied herein.

INTRODUCTION TO THE EXPERIMENTS

Studying human behaviors or trying to understand the dimensions of human experiences while paying sincere attention to environmental variables necessitates a complex assembly of variables. Much of environmental psychology research makes use of complex experimental designs in an attempt to look at the questions as completely as possible. This is also the case here.

Based primarily on Morris' theory of signs, the main interest has been directed towards successively; the sign-bearer or the building; towards the interpreter, the human individual and user of the built environment; and towards the process of communication between these two. The work has accordingly been partitioned so that three important aspects have been studied in turn.

The first study deals with the building exteriors' potential to communicate important messages, for instance, the building's factual function, and how this communication affects the individuals' experience of the buildings in other respects.

Buildings express many messages. More than for any other form of art, the products of the art of building are meant to be used and appropriated for a specific purpose or function. In concordance with the previous arguing, it was hypothesized that individuals' abilities to interpret the buildings' factual functions were important for the perception of their pleasantness. In other words, the ease of identification of the buildings' functions was expected to affect their evaluation and perception. It was also supposed that this 'identifiability' was connected with certain physical building properties and facade details.

In the second study, the main interest was aimed at the individuals' specific characteristics and interpretations of the facades' expressions and the effects these individual properties had for the environmental experience.

A problem in this type of research is the often reported discrepancy in evaluation between and within groups of individuals. When it comes to architecture these differences are often large (Canter, 1974). Some people might strongly like a certain built environment, while others might have the directly opposite opinion. These obvious difficulties for an appropriate planning of the environment, suiting as many individuals as possible, are well known but hardly investigated systematically. A more thorough study of the effects of individual traits on the perception of the built environment seemed appropriate. An adequate and consequent design in architecture will be of no great value if large groups of individuals will not notice them at all or misinterpret them, owing to unknown individual conditions in the observer.

Finally, in the third study the communication between facades and observers, or users, was studied for a special case. The individuals' education and knowledge of the message bearing elements, the facades, were thought to be of importance for the interpretation of them. Professional education and experience thus became the main objects of this third and synthesizing investigation.

The knowledge level which the observer has obtained, either by explicit education or by previous experiences, might be regarded as a special individual trait. For the planning of the built environment, the effect of this acquisition might be extremely important. Most of our modern architecture is planned by professional designers. It would be unsatisfactory if the group of experts, responsible for the physical appearance of the living environment of other individuals, would have strongly deviating evaluations and preferences concerning the built environment.

At times, this apprehension seems revealed in planning situations involving user participation. It can be interpreted as a lack of communication and understanding of the other viewpoint. However, the effects of the professional architectural experience and training upon a person's evaluations of the built environment over time has yet to be investigated. For example, if differences in evaluation are found between architects and laymen, the precise causes of such discrepancies still require pinpointing. Different hypotheses might be proffered. On the one hand, one might assume that architects are recruited from a group of individuals with special and specific traits. On the other hand, it might be assumed that professional training will affect the perceptual apparatus. Architects may look differently at houses, compared to laymen. The first step nevertheless will be to demonstrate the eventual discrepancies, their nature and extent.

The three studies thus involved individuals' assessment of environmental situations. These situations consisted of building exteriors, presented to the subjects under different conditions; either in reality or as color slides. The buildings were selected according to different criteria in the three studies. A general condition however was their usualness. They had to represent common everyday local building facades. It would certainly have been much easier to demonstrate large individual and group differences for more extreme buildings. However, it was thought that this might diminish the usefulness of the results. The buildings were also selected on information theory grounds. The level of information rate, i.e. complexity, being one of the main criteria.

Concerning the selection of the experimental subjects, in the two first studies the groups of individuals consisted of first year architectural students in the beginning of their education. It has been shown that this category is rather comparable to a general public in their perceptive reactions (Kuller, 1972). For the last study, two more aged professional groups were chosen. Here also a rather homogeneous selection was made, which most likely had a 'homogenizing' effect on the obtained results.

INTRODUCTION TO THE EXPERIMENTAL METHODS

Independent Variables

Since the present work is largely based upon the use of many different methods, it seemed worthwhile to devote a separate section to briefly describe each of the methods. As will be seen, some of the methods were newly developed for this work, others are more established measures; all of the methods come from the fields of psychology and environmental psychology. For purposes of organization, the methods comprising the independent variables, i.e. those methods which concern personality and previous experience, etc., are described first. Then the dependent variables, i.e. methods measuring the perception of the buildings are presented. They are the semantic ratings, verbal descriptions and eye movements for the presented stimuli. For the exact combination of methods used in the work, please refer to studies I, II and III. Most of the dimensions generated by the various experimental methods are briefly described in the appendixes 2 to 8.

Eysenck Personality Inventory (EPI)

One of the classic and often used personality tests was developed 1964 by Eysenck. Based on the results of this self-report test containing 48 items, individuals can be classified according to at least two main personality traits: neuroticism and extroversion. The method and the dimensions have been used for a long period of time and the traits described are generally accepted within the field (Mehrabian & Russell, 1974, Davidoff, 1975). The test, originally American, was translated and adapted for Swedish conditions by Wretmark, Peterson and Åström 1964. It is simple to administrate and the results are easy to interpret.

Arousal Seeking Tendency (AST)

An important personality trait is the individual's tendency to search actively for stimulation in the environment. This trait has been studied especially by Mehrabian and Russell (1974). They developed a self-report test, containing 48 items measuring this behavioral quality. This so called Arousal Seeking Tendency test was translated and adapted to Swedish conditions by Kuller (1977). Three dimensions are revealed by this test: arousal by change, arousal by sensuality and arousal by originality.

Social Situation

Another individual related measurement is the experiencing of one's social situation. Kuller (1978) developed a test in order to describe this experience. By means of 48 semantic rating scales the individuals have to state their evaluation of the social environment. The results of this test reveal five dimensions: social intensity, social stability, social familiarity, social organization and social friendliness.

Socio-cultural Attitudes

People's attitudes towards different events in society might affect their experiencing and evaluations of the environment. Attitudes in the sense meant here are variables which are assumed to be connected to the individual's socialization structure and strongly related to the given socio-cultural background. Therefore, a method was developed and used in these experiments in order to assess these qualities for individuals (Janssens, 1981). By means of a questionnaire containing 45 items in the form of statements on various societal aspects, the experimental subjects' attitude structure was measured. By factor analytical treatment of the answers three clear main dimensions were arrived at: political opinion, rationality and social conservatism.

Personal History

Also the individuals' personal history, the so called anamnesis, should be considered as one of the more important aspects when it concerns the experiencing of the environment. Based on a number of questionnaires on personal history available in the literature, a form was generated consisting of 61 questions. Apart from inquiries concerning the factual situation, (e.g. how many siblings, etc.), questions dealing with the individuals' subjective experiences of their conditions in different respects were also posed. Twenty items were retained and treated by factor analyses. The results were interpreted in six factors: basic security, economic security, sociability, social permanency, upbringing and dwelling comfort (Janssens, 1981).

Creativity

Even individuals' creativity has to be considered as an interesting variable when it concerns experiencing the built environment. Creativity is a hard to define concept and there are most probably different basic types of this trait. For the present work, it was decided to use a type of creativity described by Smith and Danielsson (1976),

and measured by means of a so called 'percept-genetic' technique. In the study a simplified interpretation and thus a consequent reduction of the results was applied, with approval of the authors. In short, five original dimensions were condensed into two: sensitivity and creativity. The dimension of sensitivity describes roughly the subjects' orientation towards a more human inventiveness on one hand or a more technocratic lack of imagination on the other. The dimension of creativity might here be interpreted as a measurement of the subjects' fantasy, originality and their capacity for associations.

Looking Behavior

Large eye movements, as assessed here, are considered as a basic physiological behavior measure. They have been the object of many studies (Senders et al., 1978), especially within the fields of art (Buswell, 1935, Yarbus, 1967) and advertising (Kroeber-Riel, 1980). An attempt was made to use the analyses of some basic data on the eye movement behavior as independent variables, i.e. describing the experimental subjects. Many authors have argued that eye movement behavior should be viewed as a person-related behavioral trait, affected by different personal qualities, such as personality and training (Abercrombie, 1960, Thomas, 1968, Noton & Stark, 1971).

The subjects' eye movements when looking at building exteriors were recorded by means of an ocular reflecting apparatus. These registrations were analyzed according to several relevant measures, i.e. number of eye fixations per time unit, dispersion of eye fixations, saccadic amplitudes and xy-ratios. Also, the subjects' individual scanning paths or search strategies were examined for personal regularities. Since most of these measurements seemed not to distinguish satisfactorily between the individuals, only one measure was retained as a personal measurement: saccadic amplitude or mean eye movement length.

Dependent Variables

The experience of building exteriors was studied by means of three kinds of experimental methods: semantic ratings, verbal descriptions and looking behavior

Semantic Environmental Descriptions

Kuller (1972) developed an instrument describing the dimensions of experience especially for built environments as a whole. He started from the verbal vocabulary we use to describe our everyday surroundings. On the basis of a glossary containing all possible descriptive words, he

asked experimental subjects to state their experiences for different environments in these words by means of seven-step rating scales, so called semantic scales. Kuller's work resulted in a descriptive model for built environment, consisting of eight factors or descriptive dimensions: pleasantness, complexity, enclosedness, unity, potency, social status, affection and originality.

Semantic Environmental Component Description

The dimensions described above were meant to describe our surroundings in general. Sorte (1981) through a process similar to Kuller's, developed a descriptive system for experience of environmental components/artifacts, like doorhandles, chairs, staircases and entire building facades. His findings showed that experience of different types of environmental components could be described satisfactorily by means of eleven factors: valency, mass, form, articulation, meaning, texture, structure, scale, age, color and lightness. Some of these were similar to the factors found by Kuller. Others however were new or different.

Semiotic ratings

In order to study how the individuals perceived the legibility of the presented exteriors, an extra dimension was added to the previously described semantic scales. The dimension was based on ratings of five descriptive variables: identifiable, characteristic, ambiguous, clear, and expressive. Only the first three variables gave fair indications of the studied exteriors' legibility.

Verbal Descriptions

The legibility of the presented building exteriors was also studied by means of the subjects' verbal descriptions. They were invited to relate the experienced functions of the structures and to motivate their decisions verbally. The recordings of these reports were analyzed into four measures: total verbal description time, number of words used for description, number of functions related and number of correct functions.

Looking Behavior

Eye movement measures were also used as dependent variables, i.e. describing the experimental stimuli. The four measures mentioned earlier were used again in order to assess the presented exteriors. In the first study the total looking time, time needed for identification and dispersion of eye fixations were retained as measurements.

In the last study the generated measures were: number of eye fixations, dispersion of eye fixations, saccadic amplitude and xy-ratio. In addition, the different generated eye fixation frequency plots and scanning paths were used as dependent variables.

Table 1 gives an overview of the measures used and their dimensions. Their application in the respective studies is indicated by Roman numerals.

TABLE 1: The used measures and their dimensions.

ENVIRONMENTAL MEASURES (dependent variables)

SEMANTIC RATINGS

SMB (Semantic Environmental Description, Kuller, 1972) Study I & II	PLEASANTNESS COMPLEXITY UNITY ENCLOSEDNESS POTENCY SOCIAL STATUS AFFECTION ORIGINALITY
---	---

SKB (Semantic Environmental Component Description, Sorte, 1981) Study II & III	VALENCY MASS FORM ARTICULATION MEANING TEXTURE STRUCTURE SCALE AGE COLOR LIGHTNESS
---	--

SEMIOTIC (Janssens, 1981) Study I	LEGIBILITY
---	------------

BEHAVIORAL MEASURES

VERBAL REPORT (Janssens, 1976) Study I	DESCRIPTION TIME NUMBER OF WORDS NUMBER OF FUNCTIONS NUMBER OF CORRECT FUNCTIONS
--	---

LOOKING BEHAVIOR (Janssens, 1976, 1981) Study I & III	NUMBER OF EYE FIXATIONS DISPERSION OF EYE FIXATIONS SACCADIC AMPLITUDE XY-RATIO
--	--

TABLE 1: (cont)

PERSONAL MEASURES (independent variables)

EYSENCK'S PERSONALITY INVENTORY (Eysenck, 1964) Study II & III	EXTROVERSION - INTROVERSION NEUROTICISM - STABILITY
AROUSAL SEEKING TENDENCY (Mehrabian & Russell, 1974) Study II	AROUSAL BY CHANGE AROUSAL BY SENSUALITY AROUSAL BY ORIGINALITY
SOCIAL SITUATION (Kuller, 1974) Study II	SOCIAL INTENSITY SOCIAL STABILITY SOCIAL FAMILIARITY SOCIAL ORGANIZATION SOCIAL FRIENDLINESS
CREATIVITY (Smith & Danielsson, 1976) Study III	SENSITIVITY AND HUMAN INTEREST CREATIVITY
ATTITUDES (Janssens, 1981) Study II & III	POLITICAL OPINION RATIONALITY SOCIAL CONSERVATISM
PERSONAL HISTORY (Janssens, 1981) Study II & III	BASIC SECURITY ECONOMIC SECURITY SOCIABILITY COMFORT WITH OWN DWELLING SOCIAL PERMANENCY UPBRINGING
LOOKING BEHAVIOR* (Janssens, 1976, 1984) Exp I & III	NUMBER OF EYE FIXATIONS DISPERSION OF EYE FIXATIONS SACCADIC AMPLITUDE XY-RATIO
PROFESSIONAL CRITERIA (Janssens, 1984) Study III	ARCHITECTS - NON ARCHITECTS

* Please note that LOOKING BEHAVIOR is used as both a dependent and independent variable in study III.

chapter 2: The 1st Study

HOW BUILDING EXTERIORS ARE PERCEIVED AND IDENTIFIED - A COMPARISON OF METHODS.

The well-being of humans is largely dependent on their ability to identify their environment. Building exteriors, being one important part of peoples' surroundings, evidently play a large part in this process of essential communication. But buildings do not only communicate their physical properties, identities and functions. They can also convey more subtle expressions, like power, beauty, etc.

In pilot studies (Acking et al., 1972), an attempt was made to assess physical facade properties by verbal descriptions of common observers. Unfortunately, it was found that most laymen do not wish to or cannot motivate their grounds for such particular judgements. Furthermore verbal relatings were hard to structurize and interpret. In information theory terms (Moles, 1966), it was found to be easier for the experimental subjects to describe the aesthetic messages than the semantic ones.

In order to improve this lack of information on the facades' most important physical qualities for their identification, it was hoped that the analyses of subjects' eye movements would reveal significant information on the matter.

Thus, the main problem for this investigation was the relation between the evaluation of pleasantness of a building's facade and the ease of identification of the building's factual function.

It was also supposed that this ease of identification would be affected by the appearance of specific physical properties and details.

It was hoped that meaningful information on the character of these properties could be collected by means of analyses of individuals' eye movements when looking at the facades presented. Since the use of this method is relatively unique in the field, the findings were compared with the results of other environmental assessments.

METHODS

The description of the built environment was studied by means of three different experimental methods.

Eye Movements

Eye movements are part of a complicated physiological apparatus. They can be studied in different respects and for various reasons. The type of eye movements considered most interesting for this study were the so called large eye movements, with explicit saccades (jumps) and clearly distinguishable eye fixations. Throughout this work these eye movements are also called looking behavior.

The way of moving the eyes is rather individually conditioned. In several fields, for instance art and advertising, investigations have been carried out in order to find out what stimulus properties are especially adequate in attracting fixations. Certain special conditions for the behavior have been demonstrated and analyzed.

It has been found that we can direct our eye movements consciously, depending on the mental task we are given when looking. Yarbus (1967) demonstrated how the eye movement pattern was changed systematically when he confronted experimental subjects with different looking tasks. These tasks were, for example, to define the proper content of the picture, to judge certain qualities, to search for certain details, or to interpret the connections between different parts of the picture. All these tasks evoked clearly different eye movement patterns.

Earlier Buswell (1935) demonstrated how the pictorial content affected the eye movement pattern. He showed how subjects moved their eyes more vertically when looking at gothic building interiors than when confronted with other works of art. He also demonstrated the importance of colors for our tendency to fixate certain details. Typical signal colors as red and orange appealed more to visual attention than for instance blue or green.

Generally, it is assumed that the eye will fixate on exactly the spot or detail in the visual field where the most interesting information for the given task is located. These points of fixation will thus become the centers of our attention. Using peripheral vision we can more or less consciously direct our eyes to new targets for our analyses of the observed visual picture. According to Schneider (1969), amongst others, one can discriminate two clearly defined different patterns in a typical search situation.

The first pattern will occur at the beginning of a visual confrontation with a new sight impression. One will then search fast and more or less systematically around the whole visual field in order to look for the most important, most interesting parts. After this, the second stage will take over. One now looks in a calmer and more controlled manner and even more intensely at the previously inspected parts and details as if attempting to get a clearer picture of the whole.

Several repetitions can generally be discerned. The length of the both stages will naturally be different, dependent on the content of the picture, the situation, and not least, the subject itself; both stages are more or less clearly defined. A few researchers have assumed the first stage, more than the second, to be related to specific individual characteristics (Abercrombie, 1960). The investigations here have been able to partly demonstrate such a connection. The forthcoming results also indicate that the processes described above are even valid for the observation of building exteriors.

The identification and location of the isolated fixations on the presented picture are easy to trace. Apart from the chronological appearance of the fixations on the various parts of the stimuli (see plate 3, p 34), other relations might be generated as well. One is the number of fixations appearing per time unit, giving an indication of eye movement speed.

Plottings of all fixations for a given picture, either for each individual or for a group of individuals, gives a pattern where different frequency densities are representing different dispersions of eye fixations (see plate 3, p 34). Based on these plots, a dispersion coefficient can be calculated and used to assess the stimuli. Another important measurement is the duration of the separate fixations, this means their time length. When recording the registration on video tape, small electrical pulses are overlayed on the signal at the rate of fifty cycles per second. By counting these pulses for every fixation it is possible to obtain a very thorough measurement of each fixation's duration.

Verbal Descriptions

Unstructured verbal description of observations is a natural way of communicating experiences. The individuals' perception of the presented building exteriors was assessed by their verbal descriptions. It was hoped that the results emanating from this method would improve and partly explain some of the findings from the eye movement analyses.

The experimental subjects were asked to relate verbally their impressions of the functions for the architectural structures presented. They were also invited to motivate their decisions. The descriptions obtained were recorded on tape for later treatment. The registrations were then broken down into four measurements: total description time, number of words used during description, number of related building functions and number of correct functions. All these measurements were expected to assess the ease of identification, which is also referred to as 'identifiability' throughout this work.

Semantic Ratings

With the third method, semantic ratings, more systematic judgements of the exteriors were assessed, as well as their explicit identifiability. The subjects were asked to rate the presented stimuli by means of 14 seven step semantic scales. Below is given an example of such a rating scale.

pleasant

slightly ☐ ☐ ☐ ☐ ☐ ☐ ☐ very

These scales were selected from the eight perceptual factors, developed by Kuller (1972), and one semiotic factor relating to the structures' legibility, (Janssens, 1976). All factors were represented by one variable each, except pleasantness (two) and legibility (five).

The semantic variables used in the experiment are listed in table 2 below. The dimensions of pleasantness and legibility were especially expected to give information about the hypothesized perceptual relations.

TABLE 2: The semantic variables used in the experiment.

FACTOR	variable
PLEASANTNESS	pleasant, interesting
COMPLEXITY	motley
UNITY	consequent
ENCLOSEDNESS	open (-)
POTENCY	potent
SOCIAL STATUS	expensive
AFFECTION	modern (-)
ORIGINALITY	usual (-)
LEGIBILITY	identifiable, characteristic, ambiguous (-), clear, expressive

PLATE 1: The ten building exteriors used as experimental stimuli in study I.



Building 1



Building 2



Building 3



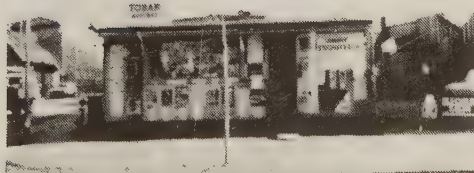
Building 4



Building 5



Building 6



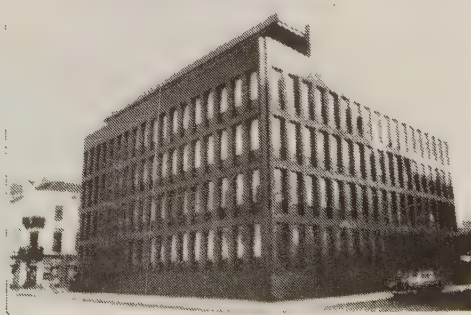
Building 7



Building 8



Building 9



Building 10

PROCEDURE

Subjects

20 first year architectural students, 10 males and 10 females, volunteered as experimental subjects. They were in the very beginning of their professional education and can therefore be compared to an interested and motivated general laity. They were aged between 18 and 29. None of the subjects had been exposed to the experimental stimuli before. A vision test was performed before the session.

Stimuli

The experimental stimuli were color slides of building exteriors. 10 were selected from a large sample in order to represent different levels of identifiability (see plate 1) They were presented, either by back projection (for the eye movement test) or on a screen. In both cases the proportional size of the presentation was the same, about 20 degrees of visual field angle. The order of presentation was randomized.

The eye movement apparatus

The persons' eye movements were registred by means of an oculary reflecting eye movement apparatus (see plate 2) The experimental stimuli - color slides of the building exteriors - were shown by means of back projection on an opaque glas screen in front of the subject. The movements were registred by means of the reflection of a polarised light beam sighted at the subject's eye.

PLATE 2: The eye movement registration apparatus and recording equipment as used in study I and III.



These reflections were overlayed on the stimuli pictures on the experimenter's TV-screen in the form of a little white dot, wandering around and representing the subject's eye fixations and saccades (eye movements). The whole procedure was recorded on video tape for later analyses. In order to keep the subject's head as stationary as possible, the individual was asked to hold the forehead on a rest support and to bite a bite-board, fixated on the apparatus.

Testing procedure

The experiments were carried out individually. They were performed after school hours. All tests were carried out in a laboratory room with dim lighting and grey walls.

The chronological order of the testing was: vision test, eye movement registrations, verbal descriptions, semantic ratings. After the vision test each subject was presented a written instruction on the content of the next experiment, the eye movement registration. The exact nature of the test was not revealed. The apparatus was introduced as an instrument measuring unspecified physiological abilities. Then the subject was invited to take a place beside the apparatus and the bite board fixating the subject's head, was prepared.

In the instruction, the subject was asked to shut their eyes as an indication for the experimenter to shift the stimulus (Locher & Nodine, 1973) and to press a button at the moment of recognition of the building's function. Both time indications were recorded on tape. Each building stimulus was preceded by a calibration screen picture, enabling accurate adjustments of eventual deviations. After five test pictures and a short pause, the factual recordings started. Since the subjects were allowed to look at the stimuli for as long as they wanted, the session lasted between 1 and 6 minutes.

(In addition to the ten experimental stimuli discussed in this report, there were also 15 color slides presented of entire street environments in residential areas (see plate 8, appendix 1). These stimuli were selected on the basis of different degrees of unity and complexity (Kuller, 1975). The results of these registrations will be commented in the overall discussion.)

After the eye movement registrations were completed, the subjects were asked to take a more comfortable seat and to look at the slides again. This time they had to relate verbally the functions assigned to each building. They were also invited to motivate their statements. Their reports were recorded on tape. This session took about five minutes.

The last session was the semantic rating procedure. Here, the subjects had to fill in a form, preceded by a written instruction, and consisting of 14 pages, one for each variable (see table 2). Each page contained 10 semantic differential scales, one for each building presented. The subjects had to express their judgements by putting marks on the preferred scale alternative. This test took on the average ten minutes.

RESULTS

Eye movement registrations

As mentioned earlier, the subjects' looking behavior was analyzed via three measures: total looking time, number of eye fixations and eye fixation dispersion. In addition, the time needed for the identification was assessed. These four measures were standardized and related to each other. Only the two time measurements showed a significant correlation ($r=.97$). The ten pictures revealed clear differences with respect to these measurements.

TABLE 3: The three looking behavior measurements for the ten building exteriors, as well as time needed for identification (N=20).

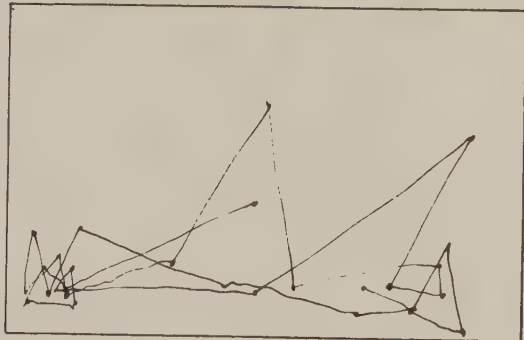
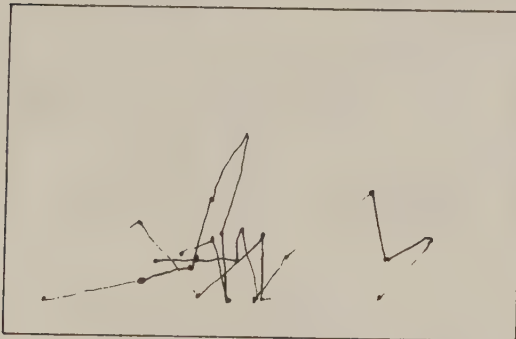
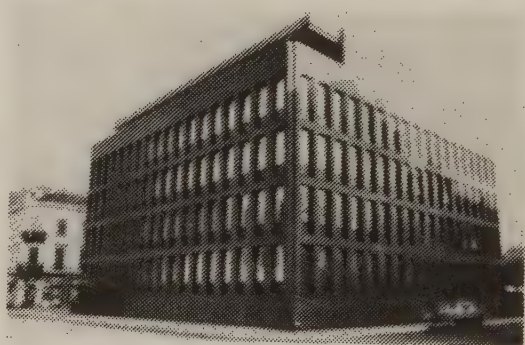
BUILDING	1	2	3	4	5	6	7	8	9	10	M
Total Looking Time (in sec)	8.81	11.24	20.42	14.62	9.08	10.50	8.32	8.19	22.47	15.31	12.89
Number of Fixations (per sec)	3.62	3.49	3.75	3.89	3.52	3.61	3.78	3.68	3.75	3.20	3.63
Time needed for identification	3.12	5.35	11.46	9.42	3.46	4.30	2.61	3.84	14.78	10.59	6.87
Dispersion of Fixations	2.27	1.82	2.26	1.96	2.17	1.82	2.03	2.37	2.19	2.01	2.07

The differences between the pictures were significant at the .01 level for all four measurements. (A significance at the .01 level means that the occurrence of similar differences between the pictures would appear by chance only once in a hundred cases.) The table shows the range of mean looking times, being between 8.2 and 22.5 seconds. The individual looking times varied between 1.1 and 66.5 seconds. The times needed for identification were on the average about half the total looking times.

The number of fixations per second showed not only significant differences between the pictures, but also within a looking period. The number was significantly higher in the beginning of each presentation and decreased at the ending ($p=.01$). This finding might be explained by the previous mentioned comments on specific periods in exploratory looking behavior (see p 26). There was also a significant difference ($p=.05$) between male and female subjects in this measure. Females were more constant in their looking behavior, they did not differentiate as much between the various stimuli as males did.

The part of the study dealing with the location of the facades' physical properties and details most important for identification was of special interest. The positions of the individual eye movements were expected to indicate which building parts were most looked at.

PLATE 3: Two examples of eye fixation frequency plots for all subjects (N=20), on top, and typical individual scanning patterns on bottom.



The frequency plots of all subjects' eye fixations on the same picture gave good illustrations of the dispersion of visual attention centra (see plate 3).

These centra are marked as the darker fields on the plot. Each small line represents one fixation. As can be noticed, the most looked at parts are the structures' entries and window openings, but often other details are fixated too. The generally most looked at part of the pictures is the field representing a normal eye level, this means first floor level.

Plots were also generated for all subjects' first five fixations. They show a very good correspondence with the plots for the total number of fixations. It means that the eye more or less is repeating its first tracks and that the most important visual attraction spots are located already after somewhat more than a second.

The scanning patterns demonstrating individual search strategies, were also generated and studied (see plate 3). No general similarities, neither between or within subjects, nor between or within stimuli were found. However, the content of the pictures seemed to have a certain overall effect on the behavior. Dependent on the ease of identification, here measured by the time needed for identification, the eye movement behavior demonstrated two clearly distinguishable patterns. When the presented building's function was perceived as easy to interpret, the eye fixations generally were more directed to the crucial visual parts, they were also shorter in time, the movement becoming more lively. When the function was hard to identify, the examination not only took longer time, but the looking behavior seemed to be partitioned into three chronological stages. After a first quick inventory, the more pronounced details were examined again but somewhat slower. Finally, if the subject still had not found the important visual clues, the behavior became somewhat distracted, the eye staring at different parts thus decreasing the number of fixations per time unit. This was taken as an indication that the subject was thinking.

Verbal descriptions

The registrations of the subjects' verbal descriptions of the buildings were analyzed into four measures: total time needed for description, number of words used for description, number of functions related and number of correct functions. Table 4 shows the results of these analyses for the ten pictures. As can be seen from the table, all measurements are highly related to each other. Significant correlations ($p=.01$) were found between all of them. The more time needed to describe the houses, the more words were used. The need of much time and many words for the descriptions was directly related to the number of functions related and inversely to the number of correct functions.

TABLE 4: Means of 20 subjects' measures on verbal descriptions for the ten building exteriors.

BUILDING	1	2	3	4	5	6	7	8	9	10	M
Total Description Time (in sec)	16.1	25.7	30.7	27.4	17.7	23.0	20.8	13.9	32.8	27.7	23.58
Number of Words	6.0	16.5	20.0	18.4	7.7	14.3	11.2	4.9	16.8	15.4	13.12
Number of Functions related	1.2	1.8	1.7	2.0	1.2	1.3	1.1	1.2	1.9	1.6	1.47
Number of correct Functions (%)	100	77	21	56	100	73	100	87	24	61	70

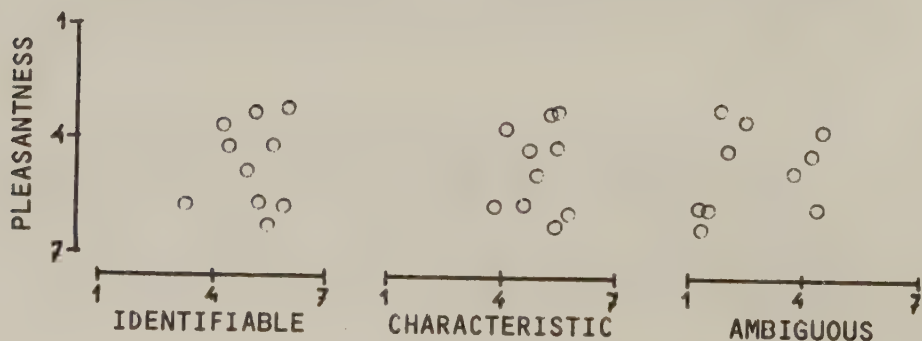
In the individual descriptions evidently most words were used to specify and describe the buildings' functions. Also the surroundings and expected users of the environments were mentioned. As for the motivations, these were few and generally rather vague. A large variety of specific building functions were related.

Semantic Ratings

By calculating means over all subjects' ratings for each house in each variable, it was possible to ascertain the stimuli's position, e.g. in pleasantness or in legibility. Fourteen measurements of the buildings' perception were first obtained. Differences in perception between the various buildings were clearly demonstrated. The different variables were related to each other and significant correlations found for three of the legibility variables: 'identifiable', 'characteristic' and 'ambiguous'. The other two legibility variables were obviously not related to this semiotic factor. However, the word 'expressive' was clearly connected with the dimension of pleasantness. More expressive exteriors were perceived more pleasing and interesting ($p=.01$). On the other hand, it was also found that the more modern houses from the sample were perceived as significantly less pleasant than the older houses ($p=.05$).

As for the main question, the connection between pleasantness and ease of identification, the results of this study did not reveal any straight relation. Figure 1 shows the relations between the buildings' pleasantness and their ratings in 'identifiable', 'characteristic', and 'ambiguous'. If there is any connection at all between the exteriors' preference ratings and their legibility, as expressed by the three variables, this relation is apparently not linear. There is however some tendency towards a curvilinear connection, especially for the variable 'ambiguous'. This may be interpreted as a stronger liking of the medium ambiguous structures.

FIGURE 1: Illustration of the relations between perceived PLEASANTNESS and the three LEGIBILITY variables.



DISCUSSION OF THE OVERALL RESULTS.

The results of the three methods used in this study were partly descriptions of the same phenomenon: the presented buildings' expressions of their functions. The study was designed to ascertain this factor by different strategies. One test of the connections between the methods was performed by factor analyzing the standardized results. All advanced statistical treatment of the data, such as factor analyses, cluster analyses and multi way variance analyses were performed by means of the BMD/BMDP computer programs (see Dixon, 1970, 1980). Table 5 shows the factor matrix for all the measurements used. High numbers (loadings) imply a high correlation to the factor, low numbers show low correlations.

TABLE 5: Factor matrix for all measures. Orthogonal rotation. Only loadings >.30 are presented.

variable	FACTOR				
	I	II	III	IV	V
motley			-.38		.82
expensive	-.45		.48	.69	
identifiable	.79		.32		.44
interesting	-.47	-.80			
characteristic	.65		.42		.46
consequent	.30		.92		-.30
potent	-.48			.83	
modern		.83	.44		
pleasant		-.88		-.42	
ambiguous	-.96				
clear	.33		.64		.52
expressive		-.78			.53
usual	.56	.75			
open		-.53			.50
total verbal description time	-.96				
number of words	-.91			-.34	
number of related functions	-.89				-.30
number of correct functions	.90	.32			
total looking time	-.95				
time needed for identification	-.94				
number of fixations per second			-.88		
spreading of fixations				.85	

The first column in the table shows a clear semiotic factor, containing most of the expected semiotic measures, except the semantic variables expressive and clear. There is a weak connection with the experience of the buildings' 'interestingness'. It might be explained in correspondence with the previous assumptions of the curvilinear relation between pleasantness and legibility. The relationship with the variable 'usual' implies that the presented buildings' legibility was considered as a more 'common' experience.

The second factor has been interpreted as the pleasantness dimension, as described by Kuller (1972). There are apparently strong connections between the experience of the buildings' pleasantness, expressiveness and age. Expressive and older houses from this sample were perceived as more pleasant and interesting. There was also a strong negative correlation with the variable 'usual', implying that the more original buildings were liked more.

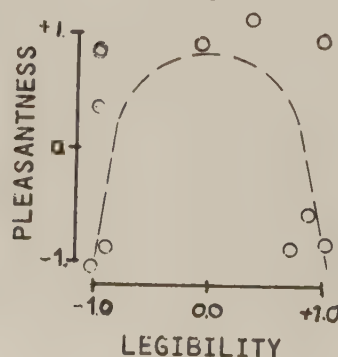
The third factor was mostly describing the semantic dimension unity and was negatively correlated with the number of fixations. Facades with high unity thus evoked fewer fixations per time unit. Since most of our modern built surroundings might be regarded as rather homogeneous in expressions, the implications of this connection are worthy of consideration. The human eye apparently is very sensitive to the coherence of the information in the built environment.

The fourth factor was interpreted as a combined potency and social status dimension, implying that potent buildings also were perceived as more expensive. From the results it can also be seen that these buildings generally were large structures. The correlation with the measurement of dispersion of the eye fixations might be explained accordingly. Large structures demand more dispersed eye movements compared with small structures in order to be explored.

The fifth factor might be conceived as a complexity dimension. It was expected that this dimension would have had some effect on the individuals' looking behavior. As can be seen, no connections with any eye movement measure, as assessed here, were demonstrated. The amount of information, or the complexity rate was apparently not affecting the way people looked at the buildings.

On the basis of these statistically more stable results, the ten stimuli were ordered according to their scores in the factors. By comparing these measures, it was also possible to clarify eventual curvilinear relationships between different dimensions, i.e. between perceived pleasantness and ease of identification.

FIGURE 2: The relation between perceived PLEASANTNESS and LEGIBILITY according factor scores.



There was a tendency for a curvilinear relationship, implying that the most and least identifiable structures were perceived as less pleasant. However, even here the tendency was too weak to be anything more than suggestive.

A relationship was demonstrated between perceived pleasantness on the one hand and unity and complexity on the other. Buildings were perceived as more pleasant if they revealed a greater number of average to high evaluations on both unity and complexity, implying a state of balance between these two dimensions. This finding has also been ascertained in other investigations (Kuller, 1972).

Finally, it should be reported that all of the above analyses were also checked for sex differences and except for the difference in looking behavior discussed earlier, no significant differences between the male and female subjects were found.

CONCLUDING REMARKS

The assessment of legibility was ascertained by different methods and the results could clearly be placed within one single factor, containing most of the expected semiotic variables. It was found that houses that were harder to identify according to the subjects' verbal descriptions and semantic ratings also evoked a longer looking and identification time.

The purported relationship between perceived pleasantness and ease of identification was however not demonstrated. The results of the eye movement registrations gave fair indications of the locations of the visually most attracting parts of the buildings as well as the extreme speed and accuracy of the human visual perceptual apparatus. The most important visual points were located mostly within a time of one second. Finally, the individual scanning patterns were shown to be extremely unique.

In future studies, it was decided to look further into people's variations with respect to perceiving the built environment. What impact do personality-related variables have upon a person's perceptual evaluation of a building? To investigate this and related questions, an experimental design must be utilized which places more emphasis on gathering information about subjects' personality traits, social situations and perhaps even political and social attitudes.

chapter 3: The 2nd Study

PERSONALITY, SOCIO-CULTURAL BACKGROUND AND ATTITUDES TOWARDS BUILDING EXTERIORS.

PROBLEM

"Beauty is in the eye of the beholder". Certainly this is a statement most of us agree upon on a merely intuitive basis. But it does not help much towards an understanding of beauty and art. Since every man is a unique being with unique abilities and background, there will be an enormous range of preferences and evaluations between all. A more scientific approach will always at some stage require a certain form of generalization. The point of departure for many studies on this topic has been the search for a fairly satisfactory common denominator for as many people's evaluations as possible.

Consequently, individual wishes concerning the environment can not be considered because of the priority given to the well-being of society as a whole. The danger is also apparent that what has to suit many, will not suit any at all. However, more knowledge should be collected on how different individuals experience certain qualities in the built environment in order to use these findings in specific practical design situations. In order to do this we need to use a more differentiated approach so that individuals can be studied in all their complexity. Such an approach has been employed for many years in differential psychology where the emphasis is on differences between individuals in psychological terms.

When studying the experiencing of building exteriors, one is constantly confronted with differences in opinions and evaluations among the individual subjects which are asked to judge buildings in various experiments. In statistical terms this is expressed by large standard deviations from the grand mean.

The investigation of this particular aspect of human experiencing will not be satisfactory if these individual differences in evaluations are not taken into consideration and analyzed adequately.

The aim of this study was to identify and study the effects of relevant individual characteristics on perception and evaluation of the built environment in general. It was hypothesized that certain personal measures would affect certain environmental experiences in specific lawful ways. It was also assumed that the effects of these individual measures would be most easily assessed in some environmental conflict situation.

Urban environments often contain built-in perceptual conflicts, for instance when older houses are mixed with new structures. Some people seem to be affected more by such changes than others. The prediction of critical situations might eventually be improved by investigating the specific personal basis for the emotive evaluation of the built environment.

DESIGN AND METHODS

Independent variables

In the same way that environmental psychology has tried to clarify the 'dimensions of experience' for built environments and their components, differential psychology has tried to demonstrate the individuals' specific traits or characteristics and incorporate these in more general descriptive and explanatory models. There are many examples and the problem nowadays is to choose the proper model among the rich assortment of descriptive systems on personality dimensions (Berlyne, 1971, Mehrabian, Russell, 1974).

Below certain dimensions are presented, chosen to be useful in the context of the present investigation and thus used as individual descriptive variables in the experiments. On the basis of the experimental subjects' positions along these personal dimensions, they were divided into subgroups, which were then compared with each other for their environmental evaluations. As mentioned earlier, both the environmental observers and the observed buildings were assessed. The former measurements were incorporated as the independent variables while the measurements of the environment were used as dependent variables. Most of the methods' dimensions are described more in detail in appendixes 2 to 8.

Eysenck Personality Inventory (EPI)

One of the classic self-report personality tests was developed in 1964 by Eysenck, the so called Eysenck Personality Inventory (EPI). Individuals are asked to respond with yes or no to 48 questions on their way of being, feeling and behaving. Based on the results of this test, individuals can be classified according to at least two personality traits: neuroticism and extroversion. The method and the dimensions have been used for a long period of time and the traits described by it are generally accepted as important and relevant within the field of psychology (Eysenck, 1964).

Arousal Seeking Tendency (AST)

Another important personality characteristic is the individual tendency to search actively for arousal from the environment. Mehrabian and Russell (1974) developed a test measuring this behavioral quality, the so called Arousal Seeking Tendency (AST), translated and adapted to Swedish conditions by Kuller 1977. The subjects have to describe their own states by marking one of five alternatives for 40 items, formulated as statements. Three dimensions are measured by this test: arousal by change, arousal by sensuality and arousal by originality.

Social Situation

Another individual related measurement is the experiencing of one's own social situation. Kuller (1978) developed a test in order to describe this experience. Via 48 seven-step semantic rating scales, the results are partitioned into five dimensions: social intensity, social stability, social familiarity, social organization and social friendliness.

Socio-cultural Attitudes

Peoples' attitudes towards different events in society may also be assumed to affect their experiences and evaluations of the environment. Attitudes in the sense meant here might be interpreted as coincidental variables with respect to an individual's socialization structure in terms of the given socio-cultural background. In an attempt to measure categories of general attitudes among individuals a method was developed for this study.

Based on the results of a pilot study and an inventory of other existing attitude scales in the field (amongst others, Allport & Vernon, 1959), about 500 social interest items were found. A further scrutinizing of the topics resulted in the retainment of 120 items covering 20 different interest fields or social events. Thus each field was represented by six statements. The subjects had to respond to these statements by marking one of five alternatives according to their agreement or disagreement. The 120 items were presented in a form and preceded by a written instruction (Janssens, 1981).

Since the aim was to identify a limited number of attitude dimensions, factor analytical treatment of the data was carried out. This statistical technique also made it possible to divide the subjects into subgroups along the resulting dimensions. First all the answers were checked and about 50 items were rejected from further analyses due to skewness of the distributions in the answers. The remaining data was standardized and factor analyses were performed with oblique rotations. Several solutions were tested and the final constellation resulted in three meaningful dimensions or factors.

The first factor was interpreted as describing the subjects' political opinion in terms of left and right wing views. Socialistic ideals dominated the one side of this scale, conservative views were demonstrated on the other. The second dimension was ascertained as a description of the individuals' state of either rationality or irrationality. The rational side of the scale was dominated by items representing conscious calculating and intellectual overview. The irrational pole showed several items on

supernatural and more emotive interests. Finally, the third dimension expressed the individuals' tendencies towards social conservatism on the one hand or progressivity on the other without being directly related to any of the previous dimensions. The poles of this dimension were showing on the one hand, the individual's willingness and flexibility towards new social and technical developments, and on the other a strong liking of old values and dislike for new life styles.

Personal History

Peoples' factual background in terms of their personal history is certainly one of the most important factors affecting opinions and experiences. The study of the experimental subjects' personal history was used to explain some of the differences that might occur in their evaluations of the environment.

Based on a number of investigations on personal background in the literature a questionnaire was generated consisting of 61 questions. Apart from questions concerning facts like number of siblings, questions dealing with the individuals' conditions in different respects were also posed. Twenty items were retained and treated by factor analyses. Several solutions were performed. The results were interpreted in six factors (Janssens, 1981).

The first factor reflected the subjects' feelings of basic security or comfort, shown by a generally happy self-perceived background and intense social contact with kindreds and old friends. The dimension also showed connections with the subjects' scores of extroversion on the EPI. The second dimension was economic security, both future expectations and today's resources. In some way this dimension seemed to be connected with a strict upbringing. The third factor described the individuals' sociability or amount of relations, reflected by the number of social contacts. It seemed to be negatively correlated with age. The fourth factor described the individuals' comfort with own dwelling and surroundings. The fifth factor described the individuals' situation in terms of urbanism versus ruralism. Finally the sixth dimension described the individuals' own family situation.

Dependent Variables

Semantic Environmental Descriptions

As in the previous study the semantic rating scales according to Kuller (1972) were also used to assess the subjects' experiences of the built environment.

This time the standardized version of the test (Kuller, 1974) was used containing semantic differentials for 36 variables, eight for the pleasantness dimension and four each for the seven other descriptive factors (see table 6). Since this test was developed to give assessments for the perception of entire environmental situations, this method was used to obtain measurements for the whole of the experimental environment (see below).

Semantic Environmental Component Descriptions

Since building exteriors were also to be assessed in this study, it was decided to use the environmental component descriptive system developed by Sorte (1981). It was hoped that this method would provide additional information on the perception of the specific buildings. The rating forms consisted of 22 scales, two for each of the eleven factors (see table 6). They were completed for three buildings in the experimental situation (see below).

TABLE 6: The semantic factors and their variables used as environmental descriptors in study II.

ENVIRONMENTAL DESCRIPTIVE DIMENSIONS AND VARIABLES (Kuller, 1972) (Descriptions of the whole square)	
PLEASANTNESS	ugly(-), stimulating, secure, boring(-), idyllic, good, pleasant, brutal(-)
COMPLEXITY	motley, subdued(-), lively, composite
UNITY	functional, of pure style, consistent, whole
ENCLOSEDNESS	closed, open(-), demarcated, airy(-)
POTENCY	masculine, fragile(-), potent, feminine(-)
SOCIAL STATUS	expensive, well-kept, simple(-), lavish
AFFECTION	modern(-), timeless, aged, new(-)
ORIGINALITY	curious, ordinary(-), surprising, special
ENVIRONMENTAL COMPONENT DESCRIPTIVE DIMENSIONS AND VARIABLES (Sorte, 1981) (Description of the buildings)	
VALENCY	friendly, boring(-)
MASS	massive, strong
FORM	rounded, edgy(-)
ARTICULATION	decorated, simple(-)
MEANING	real, temporary(-)
TEXTURE	shiny, scratched(-)
STRUCTURE	composed, rich in detail
SCALE	dominating, large
AGE	old-fashioned, unmodern
COLOR	colorful, grey(-)
LIGHTNESS	dusky(-), dark(-)

PROCEDURE

Testing the Subjects

The experimental subjects, 33 first year architectural students, 19 males and 14 females, aged between 19 and 45, were asked to take a battery of tests. The experiments were presented as a part in their educational exercises in environmental psychology. The testing program was performed in the beginning of their professional training.

The personal self-report measures, the independent variables in the experimental design, were assessed on two different occasions. The testing was divided into two sessions and performed with a one week interval. On the first occasion they took the Eysenck Personality Inventory, the Arousal Seeking Tendency, and the form on Social Situation. On the second occasion the subjects completed the forms on Attitudes and on Personal History. The testing was carried out in group in an ordinary lecture hall at the school of Architecture.

Evaluation of Environmental Stimuli

A newly changed town square environment was chosen as the experimental stimulus. In addition to the entire square situation, three house facades on the square were chosen to be evaluated. The exteriors to be assessed were two older houses and one new (see plate 4). This newly built modern grocery market/department store replaced two older dwelling houses and was considered by many to 'not fit well' into the older environment. The whole setting might thus be interpreted as an environmental conflict situation.

All environmental assessments, the dependent variables in the experimental design, were made on location in group on a cloudy autumn afternoon. The subjects were first invited to walk around on the square and then introduced to the rating forms. They read the written instructions and completed the first semantic rating form on the description of the environment as a whole (Kuller, 1972). The subjects were asked not to communicate with each other during the evaluations. The forms were collected and then the individuals were divided into three subgroups and each of them was presented to one of the selected building facades. New semantic rating forms (Sorte, 1981) were distributed and all groups judged the three facades successively. The whole session took about one hour.

PLATE 4: Pictures of the three houses used as experimental stimuli in study II. The whole square was also assessed.



House A



House B



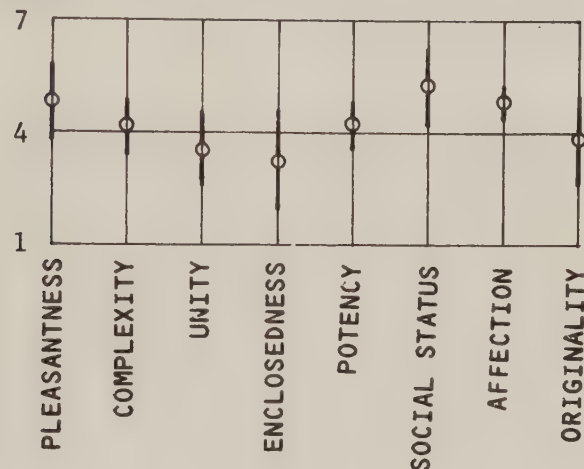
House C

RESULTS

Results for the Evaluation of the Square

According to the results of the ratings in the eight environmental descriptive dimensions (Kuller, 1972), the square was generally perceived as slightly above average in pleasantness (4 on a seven-step scale). An overview of the findings revealed that complexity and unity ratings were near the average and well balanced. The square's enclosedness was perceived as rather spacious and open. The potency and originality were average while the social status and affection value were high.

FIGURE 3: The means and standard deviations for the 8 semantic factors describing the whole square (N=33).



Environmental Evaluations and Personal Measures

As mentioned earlier, the subjects were divided into three subgroups according to their scores on the personal measures. These groups were then compared for different environmental evaluations. By means of variance analyses the eventual differences between each subgroup were ascertained. Since not all the subjects took part in both personal assessment sessions, the analyses are based on somewhat different numbers of subjects. The figures in the following tables are based on the subjects' semantic ratings in seven-step scales, 1 implies slightly and 7 implies very much of the rated quality.

A significant effect was found for neuroticism and pleasantness, as can be seen from table 7. It appears that subjects with high scores in neuroticism rated the square as more pleasant.

TABLE 7: Evaluations of the square's pleasantness for three levels of neuroticism ($p=.04$).

	Neuroticism			M (N=33)
	low (n=10)	medium (n=10)	high (n=13)	
Pleasantness	4.8	4.3	5.4	4.9

For the personal measures, assessed by the Arousal Seeking Tendency test, no significant differences could be found. However the measures concerned with ones own social situation (Kuller, 1974) revealed some significant effects. The dimension of social organization seemed to be important for the persons' environmental perceptions (see table 8). The table shows that people who perceived their own social situation as well organized also experienced the square as more pleasant, coherent and potent.

TABLE 8: Evaluations of the square's pleasantness, unity and potency for three levels of social organization ($p=.05, .06, .06$).

	Social Organization			M (N=28)
	low (n=9)	medium (n=9)	high (n=10)	
Pleasantness	4.4	5.4	5.2	5.0
Unity	2.9	3.7	4.2	3.6
Potency	3.8	4.1	4.5	4.1

The individuals' socio-cultural attitudes did not affect the perception of the square to a great extent. Concerning personal history, the economic security was related to the experience of the square's affection value (see table 9). As can be seen, the square was more loaded with affection for persons who perceived their own economic situation as more secure.

TABLE 9: Evaluations of the square's affection three levels of economic security ($p=.02$).

	Economic Security			M (N=33)
	low (n=11)	medium (n=11)	high (n=11)	
Affection	4.5	5.0	5.1	4.9

Results for the Descriptions of the Buildings

The results of the semantic ratings according to Sorte's dimensions allowed a fairly good comparison between the three building facades used as experimental stimuli. The new building (C) was perceived as less pleasant, newer, less articulated and less meaningful but more edgy. The small white house (B) was evidently judged as smaller both in scale and mass, but also lower in structure and color than the other two facades. The larger old house (A) was perceived more positive, with coarser texture and larger mass, scale, age, articulation and roundness. The standard deviations for the individuals revealed generally larger values for the new building. This means the experimental subjects were less congruent with respect to their evaluations of the new house in comparison to the older ones. On the whole, the judgements of the experimental subjects in this investigation were fairly comparable to those in a previous investigation (Sorte, 1981).

Environmental Component Evaluations and Personal Measures

The measures from the Eysenck Personality Inventory were related to some of the descriptive dimensions of the building exteriors. As can be seen from table 10, people who scored higher in neuroticism perceived the old facades as older and the new one as newer than the individuals with the more stable tendencies. Exactly the same relation was found for the perception of the facades' valency, although this was not statistically significant ($p=.08$). The older houses were generally perceived as more pleasant and the new house as less pleasant by persons high in neuroticism. This finding might be compared to the effects of the neuroticism dimension upon the subjects' experience of the whole square's pleasantness (see table 7, previous page).

TABLE 10: Evaluations of the building exteriors in age for three levels of neuroticism ($p_{int}=.002$).

AGE	Neuroticism			M (N=33)
	low (n=10)	medium (n=10)	high (n=13)	
House A	5.8	6.2	6.7	6.3
House B	5.6	5.3	6.5	5.9
House C	2.6	2.8	1.5	1.9
	4.7	4.4	4.9	4.7

People's level of extroversion was related to the perception of the building exteriors' structures (table 11). The individuals with the highest scores in extroversion experienced the houses as more complex, i.e. higher in structure.

TABLE 11: The evaluations of the buildings' structure for three levels of extroversion ($p=.02$).

STRUCTURE	Extroversion			M (N=33)
	low (n=10)	medium (n=13)	high (n=10)	
House A	2.9	3.9	4.6	3.8
House B	2.1	2.3	2.4	2.3
House C	3.7	3.7	4.7	4.0
	2.9	3.3	3.9	3.3

The dimensions obtained from the Arousal Seeking Tendency test revealed only a few insignificant tendencies. However, the experience of social stability was related to the perception of the buildings' scale (table 12). People who experienced their own social situation as more stable generally perceived the houses as much smaller in scale, especially the older houses.

TABLE 12: The evaluation of the buildings' scales for three levels of social stability ($p=.01$).

SCALE	Social Stability			M (N=28)
	low (n=11)	medium (n=8)	high (n=9)	
House A	5.7	6.3	4.6	5.5
House B	3.6	3.4	2.8	3.3
House C	5.2	4.4	4.4	4.7
	4.9	4.7	3.9	4.5

Concerning socio-cultural attitudes there were some interesting connections, especially for social conservatism. Table 13 demonstrates how people with a high social conservatism also rated all houses higher in valency.

TABLE 13: The evaluation of the buildings' valency for three levels of social conservatism ($p=.01$).

VALENCY	Social Conservatism			M (N=33)
	low (n=11)	medium (n=11)	high (n=11)	
House A	5.7	5.8	6.0	5.8
House B	4.4	5.7	5.6	5.2
House C	2.3	3.0	3.1	2.8
	4.1	4.8	4.9	4.6

The opposite relationship was found for the evaluation of the building scales (table 14). The more conservative subjects perceived the houses as smaller in scale. A tendency also showed that the same subjects rated the houses generally as more articulated ($p=.07$). Here an obvious connection is revealed between the perception of the houses' valency on the one hand and their scale and articulation on the other. People who perceived the houses more positive in valency also rated the houses smaller in scale and more articulated.

TABLE 14: Evaluations of the buildings' scales for three levels of social conservatism ($p=.005$, $p \text{ int}=.03$)

SCALE	Social Conservatism			M (N=33)
	low (n=11)	medium (n=11)	high (n=11)	
House A	5.6	5.4	5.5	5.5
House B	4.1	3.1	2.8	3.3
House C	5.7	4.0	5.5	5.0
	5.1	4.2	4.6	4.6

Finally, the subjects' personal history was shown to have some effects upon the perception of the buildings; especially the individuals' basic security. Table 15 shows that people who felt more confident in their basic security perceived the houses significantly smaller in scale and mass. An interesting tendency also revealed a positive connection between the comfort of one's dwelling and the experience of the valency of the buildings.

TABLE 15: The evaluations of the buildings' mass and scales for three levels of basic security ($p=.01$, $p=.005$)

MASS	Basic Security			M (N=33)
	low (n=11)	medium (n=11)	high (n=11)	
House A	6.2	5.8	5.6	5.9
House B	4.2	4.8	3.0	4.0
House C	5.8	6.1	5.5	5.8
	5.4	5.6	4.7	5.2

SCALE

House A	6.2	5.4	4.9	5.5
House B	3.4	3.9	2.7	3.3
House C	5.3	5.3	4.5	5.0
	4.9	4.9	4.0	4.6

In conclusion, it should be mentioned that analyses were also done in terms of the subjects' sex. However, the analyses revealed no significant differences between the two sexes.

DISCUSSION

The study demonstrated many significant and relevant connections between personal self-report measures and the perception of built environment. In other words, the assessment of the built environment was clearly affected by personal characteristics. Especially important in this respect were the measures of neuroticism, social stability, social conservatism and basic and economic security.

As Kuller reported in 1972, most of the environmental descriptive dimensions were shown to be susceptible to individual variations. All of the environmental or environmental component descriptive dimensions used were affected by at least some personal measure. Of Kuller's environmental factors, the dimensions of affection and unity were most highly affected. As for the factors established by Sorte, 1981, scale and mass, as well as articulation and color were found to be affected more than the others by the personal measures (Janssens, 1981).

It might be assumed from these results that an inner feeling of comfort, security and balance will affect environmental perception in a positive way. Houses are for instance perceived as smaller in scale and mass, and maybe less threatening by secure individuals. These persons also rated the houses higher in complexity, a factor we know is closely connected with the perception of pleasantness (Berlyne, 1971). The findings here are in support of the model presented by Canter (1974) in which the individuals' personality is described as one of the more important explanatory factors for discrepancies in environmental evaluations.

However some contradictory results were obtained. The socially more progressive individuals for instance, disliked not only the older houses, but also the new one. The more extrovert individuals perceived all houses as higher in structure, more complex, where one would have expected the contrary. More extrovert people, according to Eysenck, are by their nature asking for much stimulation from the environment (Eysenck, 1973). They would thus be expected to underestimate the complexity compared to the more introvert individuals.

On the whole, the findings gave an interesting insight into some of the complex connections between the subjects' perception of the self and his experience of built environments. The conclusions might be useful if adapted to specific planning situations, calling for a more attentive and differentiated approach for the designing of built environments. They clearly demonstrate the difficulties in planning optimal general environments for all individuals.

There are strong indications that, apart from the personal measures studied here, the individuals' factual knowledge of the topic, planning and architecture, should be considered an important explanatory factor for group differences. The effects of professional training in the field of environmental perception might therefore be a fruitful object for further investigations.

One possible way of approaching this might be the study of differences in looking behavior between architectural professionals and laymen. It could be hypothesized that architectural training would evoke deviations in eye movement behavior, since the education of experts aims at a larger practice in reading information in one's own field. Architects and laymen might not look at the same things and thus base their evaluations on different factors. Study III which follows takes up these kinds of questions.

chapter 4 : The 3rd Study

DIFFERENCES BETWEEN ARCHITECTS AND LAYMEN IN THE PERCEPTION OF BUILDING EXTERIORS

PROBLEM

People's factual knowledge about certain topics evidently affects their behavior and perception. Professionalism within a certain area will generally cause a more adequate and more oriented evaluation pattern within the specific professional field. It has been demonstrated in several previous investigations that architects and planners, experts in the art of building, differ in their evaluations of built environments from an ordinary laity (Craik, 1975, Zube et al., 1975).

In the present study, in addition to professionally caused differences in environmental evaluations, it was hypothesized that the two groups would also deviate in terms of their eye movement behavior when looking at buildings. Moreover, it was considered important to study how the groups of architects and laymen differed concerning various personal measures and how any discrepancies in those measures, besides the professional ones, would affect the experiencing and evaluation, as well as the looking behavior.

This study was the third in a series concerned with the communication between people and the built environment. It was not only designed in order to clarify the mentioned problems, but also with the specific aim to apply and verify some of the previously generated methods and results (see study I and II or work reports, Janssens, 1976, 1981).

Several questions are treated in this study. The main problem is the clarifying of the connection between architectural training and concordant changes in environmental evaluations and preferences. Since many discrepancies are also found between architects in this respect - not all experts like the same buildings - there must be grounds for investigating deviations not only between architects and non-architects but also amongst architects themselves.

Another hypothesis concerns factual changes in looking behavior for trained architects when looking at buildings, i.e. different eye movement patterns compared with the non-architects. If such deviations would characterize the experts, they would have different environmental information input as compared to the general public and this could be one explanation for the group discrepancies found in environmental evaluations.

A further assumption might be that architects are recruited from a very specific sample of the general public, with particular personal characteristics. Their deviating evaluations would thus be explained by such a 'self-selection' assumption.

METHODS

Independent variables

Since the main problem was to investigate group differences in various respects between architects and laymen, the selection of the non-expert group was a crucial decision. It is obvious that the size of the demonstrated discrepancies between experts and laymen would be dependent on the status of the selected groups. It would evidently be easier to demonstrate large differences in building preferences between a group of highly educated professionals, such as architects, and a group of non educated youngsters. Several uncontrolled variables would bias such a comparison. Instead it was decided to compare the group of architects with another group of academics, in this case chemical engineers.

Apart from the professional categorization, several personal measures were used as independent variables. Some of them were identical with the ones used in the previously reported study I (p 25). The Eysenck's Personality Inventory was used again, enabling a description of the experimental subjects along two dimensions: extroversion - introversion and neuroticism - stability. The two forms generated in the previous study on the individuals' socio-cultural attitudes and on their personal history were again used here. The attitude form assessed: political opinion, rationality and social conservatism.

The personal history inventory attempts to assess the subjects in: basic security, economic security, sociability, comfort with the own dwelling, social permanency and upbringing. The last two dimensions are based on new factor analytical treatment of the data and interpreted somewhat differently from the previous study. The results of the personal history inventory are too dispersed to give only one factor solution. Each group of subjects, especially if the sample is homogeneous, might thus provide certain independent results for this test.

Creativity

The individuals' creativity was selected as an additional variable in the context of this study. Not only might it affect the experience of the built environment, but it might also be a critical discriminating factor between the two subject groups, architects and laymen.

Creativity is however a hard concept to define and there are most probably different types of creative dimensions (MacKinnon, 1962).

For the present work, it was decided to use the interpretation given by Smith and Danielsson (1978) and measured by means of a so called 'percept-genetic' technique. By means of a tachistoscope a picture of a still life is shown with a very short exposure time (a split second). The exposure time is then increased in steps until a correct interpretation of the pictorial content is reported. Then the exposure time is decreased again (the pictorial content is the same) until the shortest time is reached. The experimental subject has to report his spontaneous experiences and associations of the picture for each exposure. The analysis of the verbal statements, according to given standards, form the foundation for a number of personality traits, among them creativity.

In this investigation a simplified interpretation was approved by the authors. The number of dimensions was thus reduced and five of the original measures were condensed into two: sensitivity and creativity. The dimension of sensitivity describes roughly the subject's orientation towards a more humane inventiveness on one hand or a more technocratic lack of imagination on the other. The dimension of creativity might be interpreted as a measurement of the subject's fantasy, originality and capacity to associate.

Eye Movements

The results from the first study gave a fair indication of the usefulness of eye movement measurements as dependent variables. In addition, in this study, they were used as a means to describe the subjects. It was assumed that different individuals would demonstrate specific and systematic differences in looking behavior and that these deviations might be caused by professional education and experience.

Important improvements of the analyzing technique were performed. It was, for instance, noticed in the first study that about five to ten seconds exposure time of the presented stimuli would provide enough relevant data for the analysis. Also the pictorial content of the experimental stimuli was simplified by removing unnecessary details in the fore- and background of the buildings. By using a semi automatic coordination system, the process of locating the isolated eye fixations was not only done faster but also with larger accuracy than before. The introducing of computerized treatment of the data led to the generating of several more specific measures for the behavior.

Seven such measures were generated in addition to the two previous ones, number of eye fixations per time unit and dispersion of the fixations (see study I). Two of the seven new measures were retained for the further analyses: saccadic amplitude, being the mean length of all eye movements for a certain presentation, and xy-ratio, being the relation between the horizontal and vertical components in the eye movements for a specific visual presentation.

The inspection of these four measurements revealed once again the very unique nature of eye movement behavior. Hardly any relevant individual characteristics could be established. In other words, all individuals showed an almost random variation in the measures of looking behavior. The only stable individual measure seemed to be the mean saccadic amplitude. Individuals were more constant in the length of their eye movements (see below) than for any of the other measurements. This specific trait therefore was retained as the only independent variable of looking behavior.

Dependent variables

All the four eye movement measures mentioned above were retained in order to describe the experimental stimuli - the presented building exteriors. The building exteriors were also assessed by semantic ratings. Since isolated building exteriors might be interpreted as environmental components, it was decided to use the environmental component descriptive system (Sorte, 1982). The system, also used in the previous study (II) gives a description of the exteriors in eleven dimensions. Each dimension was defined by two variables (see table 16). Accordingly, the subjects had to rate the buildings in 22 scales.

TABLE 16: The 11 environmental component descriptive dimensions and their variables, used as dependent measures in study III.

VALENCY	friendly, boring (-)
MASS	massive, heavy
FORM	edgy, irregular (-)
ARTICULATION	decorated, simple (-)
MEANING	real, not thought out (-)
TEXTURE	shiny, scratched (-)
STRUCTURE	rich in detail, composed
SCALE	large, dominating
AGE	unmodern, old-fashioned
COLOR	colorful, grey (-)
LIGHTNESS	bright, dark (-)

PROCEDURE

Subjects

In order to study any possible professionally caused discrepancies between architectural experts and laymen, the subjects were selected accordingly. Since the length of the professional training probably affects such discrepancies, it was decided to select only professionally practicing subjects, aged 40-65. In a letter, all architects in the appropriate age range, named in the local member register of the professional confederation (about 35 persons) were informed about the study and invited to take part as experimental subjects. Unfortunately, almost no women in the stipulated ages were available, thus excluding a meaningful sampling in this respect. Twenty of the experts, of various ages, were retained and booked as experimental subjects. As laymen group, it was decided to use chemical engineers with a university degree. They were considered to be as similar to the architect category as possible, apart from their professional technical background and interest. About twenty-five male engineers were contacted, twenty were retained as subjects, matching the architect group in age.

Stimuli

Other studies have revealed that the building's ascribed function affects the perception of the structure's pleasantness (Prak & van Wegen, 1974). It was therefore decided that, unlike the first experiment, the presented buildings' functions should be identical. In order to avoid the eventual influences of high originality, only common buildings were used in this study.

Most of today's new dwellings in Sweden can be grouped into two categories. On the one hand there are the high-rise multi-family blocks of flats, mostly with rental apartments, the other category is one-family dwellings. Both have their own specific expressions. The local image of a dwelling is best represented by the detached one-family house, with pitched roof, large windows and frontal entries, while the high-rise blocks on the contrary are perceived as more abstract, with their four to ten storeys vertical extension and windows and balconies arranged in symmetrical patterns, while the entries are less pronounced. Many of these high-rise blocks bring forth associations to sculptural monuments rather than residences, especially with their lack of connection to the immediate surroundings. They are therefore seldom experienced as common 'houses'.

It might be assumed that architects are more accustomed to the reading of these more abstract messages (Appleyard, 1970). If one wants to study how people read the more abstract lines of the architectonic language, based on terms of balance, composition, symmetry and so on, it might be advantageous to limit the scope of the experimental stimuli

to include only parts of the high-rise facades. In this way the abstract properties will become clearer and easier to investigate. For this reason, the high-rise buildings were presented as photographic cuts while the pictures of the detached houses were shown in their entirety. The high-rise cuts were made so that only four intermediate storeys were presented without either roofs or entries visible. In order to prevent any effects of the pictures' perspective, the houses were photographed from the front. From a large sample, 12 high-rise building exteriors were retained, representing different complexity levels, according to the results from evaluations in a pilot study.

In addition, a sample of low rise one family houses were selected. In an investigation Sorte (1982) used 30 one-family houses as experimental stimuli. These houses were evaluated by his subjects, a mixed group, in all the environmental component descriptive dimensions. On the basis of these results, 12 pictures from this sample were retained for the present study, also representing different complexity levels. The pictures were modified somewhat for this study since they now were also to be assessed by eye movement measures. The fore- and background of the low-rise stimuli were standardized as in Sorte's study, by using one hedge and suburban garden for all the houses. The proportional sizes of the buildings were increased so that they filled most of the picture surface.

All together, 24 color slides of common houses, 12 low-rise one-family houses and 12 cuts from high-rise multiple-family blocks, were used as experimental stimuli (see plate 5).

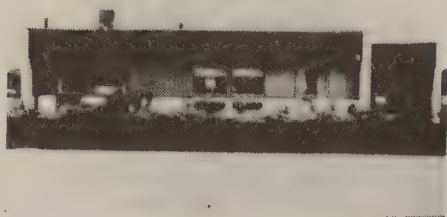
Testing Order

The subjects were given a battery of tests assessing their own personal characteristics in different respects, their eye movements when looking at the building exteriors, and semantic ratings of their perceptions of the presented facades.

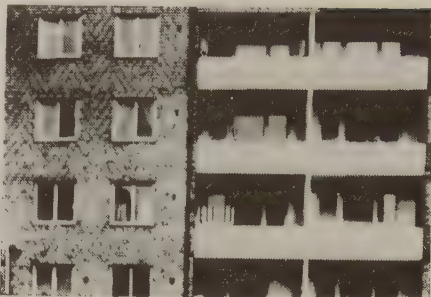
The chronological order of the testing was: vision test, eye movement registrations, Eysenck Personality Inventory, building evaluations by semantic ratings part 1, creativity test by the percept-genetic method, building evaluations part 2, attitudes form and personal history questionnaire. The semantic ratings of the stimuli were divided into two parts since this was a time demanding and fatiguing procedure. All tests were performed individually and on one occasion.

The vision test, eye movement registrations and semantic ratings of the building exteriors were performed in the laboratory room as described in the first study. The percept-genetic experiment was carried out in another laboratory, within walking distance from the previous one.

PLATE 5: The 24 building pictures used as experimental stimuli in study III



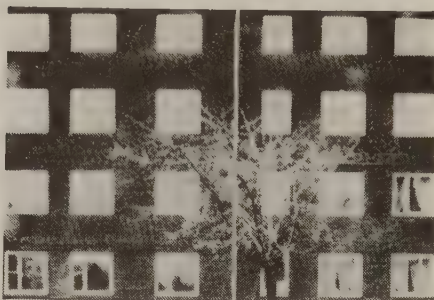
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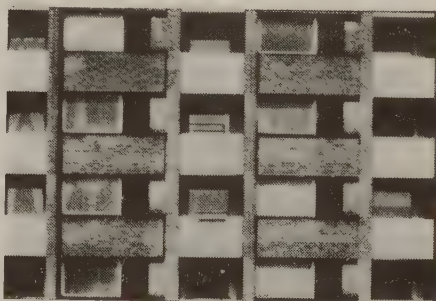
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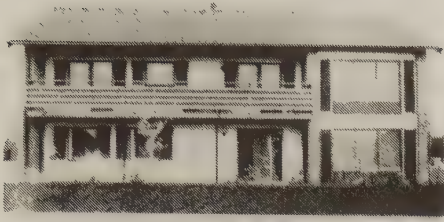
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PLATE 5: (cont)

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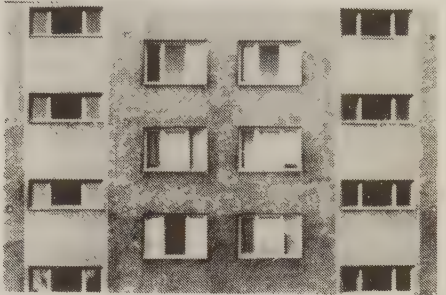
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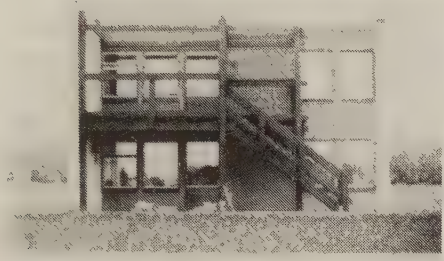
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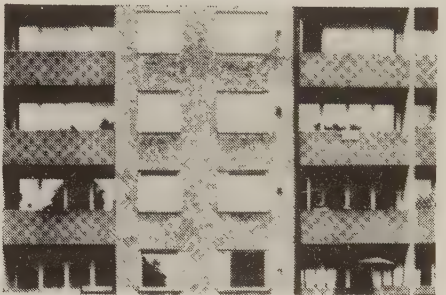
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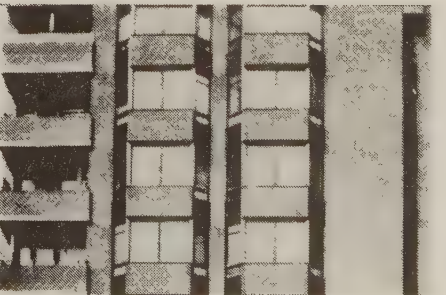
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Finally the questionnaires on the subject's attitudes and their personal history were completed in privacy in a coffee room at the institute while some refreshments were served. Afterwards the aim and content of the investigation and the particular methods were explained in general terms. The individuals were asked not to relate this information to anyone until all subjects had been tested.

All together, the experiments took 2-2.5 hours. Most of the time, about one hour was spent rating the building exteriors. The registrations of the eye movements took about 10 minutes, the percept-genetic test about the same and the attitudes and personal history questionnaire together about 45 minutes. Most of the subjects were tested during mornings and afternoons.

RESULTS

Semantic ratings in general

The subjects' evaluations of the presented building exteriors were registered by means of semantic ratings according to Sorte (1982). Eleven dimensions were defined by two descriptive variables each (see table 16). Since the test was developed with the aim to describe all types of environmental components or artifacts, from door handles to chairs, machines and buildings, some of the dimensions were expected to become either less apparent or more pronounced for the description of building exteriors only.

The ratings in all variables were treated by factor analysis and some differences compared to Sorte's dimensions were noted. It was, for instance, found that the dimensions articulation and structure hardly could be discriminated from each other. They were consequently put together into one single complexity factor. On the other hand the dimensions of meaning, texture and lightness did not discriminate well enough between the presented stimuli. Apparently are house facades all evaluated as rather meaningful and coarse and medium bright. These three dimensions were not retained in the further analysis. Evaluations were thus generated for seven environmental component dimensions: valency, scale, mass, complexity, form, age and color.

Semantic ratings and personality

Apart from the professional categorization, the subjects were grouped according to their scores on the different personal measures. As in the previous study, the assessments for all individual dimensions were used in order to divide the subjects into subgroups for each dimension. Generally three equally large subgroups were used for a given personal measure. These subgroups were defined as low, medium and high in the respective dimensions.

There were only a few statistically significant main effects. This means the personal measures alone were not sufficient in order to explain discrepancies in environmental evaluations. The main reason for this failure in demonstrating significant main effects for the personal measures was probably the homogeneous nature of the experimental groups. Most of the significant effects were interactions. The interpretation of the results is consequently obscured by this fact. However, some simple effects were noticed as described below.

Neuroticism, as measured by the Eysenck Personality Inventory, affected the perception of the buildings' complexity. The individuals with more stable tendencies experienced the facades as less complex ($p=.03$). On the other hand the more stable architects perceived the houses as more pleasant, whereas the more stable chemists did not ($p=.03$).

The attitudes form gave some interesting tendencies. People who were scoring higher in rationality perceived the exteriors as less pleasant ($p=.08$). Generally persons scoring high in conservatism perceived the houses as more colorful ($p=.06$).

As for the personal history inventory, basic security affected the perception of the exteriors' complexity, scale and mass. People who were less secure perceived the houses as more complex, larger in scale and more massive ($p=.01$, $.06$, $.04$). The last two relations were also demonstrated in the previous study (II).

Actually, most of the personal measures were related to some semantic environmental dimension. However, as mentioned earlier, the effects were often hard to interpret since they were based on more or less complicated interactions.

Semantic ratings and profession

The judgement of the building exteriors by means of semantic ratings created certain difficulties for the experts. The architects generally used all the descriptive words (such as grey, old-fashioned, edgy and so on) as steps in a valency scale, according to their opinion about 'good' versus 'bad' architecture. This conduct is in concordance with the observation made by Osgood on the semantic evaluations of experts in their own field (Osgood et al, 1957). Comments like: "Is it good for a house to be grey or edgy?" were commonly heard in this experiment. Certain experts actually wrote good - bad on top of the respective rating scales besides the original descriptive word.

The laymen, the chemical engineers, did not have the same type of problems. Their difficulties were more grounded on the semantic content of the test. How should the separate words been interpreted? 'Dominating' in relation to what? 'Simple' in contrast to 'expensive' or 'complicated'? The conditions for an equal semantic judgement between the groups were thus not explicitly equivalent.

The analysis of the ratings revealed some interesting findings as shown in table 17. The scale of the buildings was described by the ratings 'dominating' and 'large'. The word 'large' clearly differentiated the two house types. The high-rise blocks were consequently rated much larger than

the low-rise dwellings. For the word 'dominating' the results were somewhat different and here a significant discrepancy between the two individual groups was revealed ($p=.01$). While the laymen retained the evaluation of the facades' factual sizes even for this variable, the architects left this interpretation and tried to relate the facades to something else, e.g., the environment or houses in general. While the mean dominance for the low-rise houses' dominance equalled that of the high-rise blocks' for the experts, the laymen evaluated the high-rise blocks as much more dominating than the low-rise dwellings.

TABLE 17: Architects' and laymens' ratings of the two building types for the descriptive variables in the SCALE and AGE dimensions.

	DOMINATING		LARGE		OLD-FASHIONED		UNMODERN	
	low	high	low	high	low	high	low	high
	rise		rise		rise		rise	
Architects	4.0	4.0	3.5	5.7	3.6	3.6	4.5	4.3
Laymen	3.7	4.7	3.8	6.0	3.3	4.1	3.4	4.4
	3.9	4.4	3.6	5.9	3.4	3.9	4.0	4.3

The houses' age were described by the variables 'unmodern' and 'old-fashioned'. The laymen perceived the low-rise houses as less old-fashioned and more modern than the high-rise blocks ($p=.02$). The architects on the other hand made hardly any distinctions between both house types in this respect.

The factor analytical treatment of the ratings showed results of the same kind. The architects differentiated more between the quantitative and qualitative concepts. They seem to need more dimensions than the laymen in order to describe satisfactorily their experiences, although the laymen are academics as well. These findings might demonstrate one of the more typical conflicts in the conceptual framework of experts. As Osgood (1957) and Berlyne (1974) have reported, experts' evaluations are dominated by a main evaluating dimension on one hand, but on the other they have a large variety of differentiating criteria within their own field.

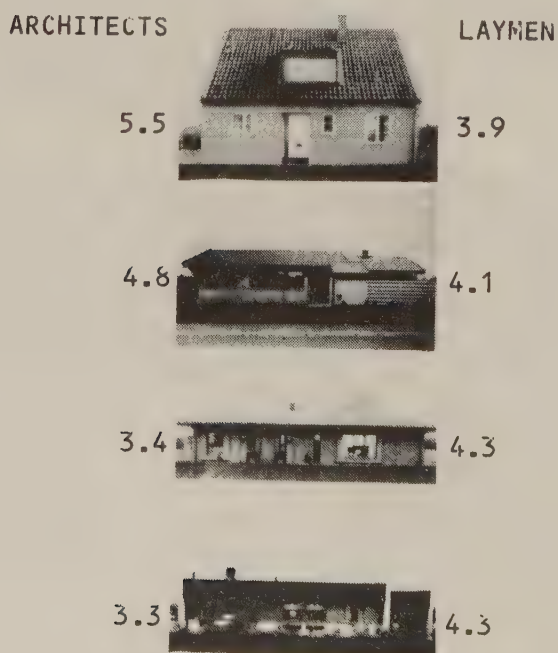
The factor analytical treatment of the ratings revealed other interesting differences as well. For the chemical engineers, the experience of complexity was connected with the experience of both color and valency. The complex facades were thus perceived as more colorful and less boring as well. For the architects the dimension of color was strongly connected with the valency dimension, since both variables 'colorful' and 'friendly' were assigned to the same factor.

The next factor, a combination of scale and mass, also revealed discrepancies between the two subject groups. Massive and heavy houses were perceived as larger and more dominating by the laymen. For the architects, on the contrary, the word 'dominating' was not correlated to any other word. In other terms, the experts did not always perceive large houses as being the most dominating, as laymen generally did.

Even the dimension of age, as described by the variables 'old-fashioned' and 'unmodern' revealed a difference in so far that the architects differentiated between these two variables and assigned both to different factors. Thus old-fashioned houses were not always experienced as unmodern by experts, but mostly by laymen. These results verify the conclusions from the ratings in the separate variables (see table 17).

Another interesting analysis is the demonstration of differences in facade preferences between the two subject groups. By ordering the building exteriors according to their valency evaluations, it can be noticed that the architects seemed to prefer simpler or less decorated facades (for instance houses 6, 7 and 9) while the laymen preferred more ornamented exteriors (for instance houses 1 and 5). Both groups however agreed strongly on what facades are most disliked. Especially the plain, uniformous high-rise facades were rated low (for instance houses 8, 16 and 20). Plate 6 shows the low-rise houses causing the largest preference discrepancies between architects and laymen, illustrating the above conclusions.

PLATE 6: Preference differences between architects and laymen for four building exteriors. The figures are the group's ratings for VALENCY in seven-step scales (1 = slightly, 7 = much).



Differences amongst architects

The occurrence of professionally caused differences within the architectural group itself can not be excluded. Architects may interpret their call and profession from different points of view (Prak, 1984). Architecture is both one of the visual arts and a technical oriented field with direct user related aims and demands. The architect may see his professional role as being either visionary and aesthetic showing the way to the future, or as the public servant, using his abilities in a more directly practical way. Even if very few architects entirely belong to one of these categories, the inclination for the one or the other side might affect the evaluation of the built environment.

It was hypothesized that one group of architects would prefer more straight forward simple facades, as suggested earlier. Another group was expected to have evaluations more in concordance with the general laity, this means a liking of more decorated and elaborated exteriors.

The existence of these and other subgroups may be assessed by means of so called Q-analysis. Analyzing the architects' ratings of the facades' 'boringness', the individual experts may be assigned to various clusters. Each of these groups will have their own preference pattern, expressed by a certain combination of building facades.

The results of the Q-analyses showed that only one clear cluster could be identified. One architect group, consisting of ten individuals, based their preferences mainly on the facades' complexity levels. The more complex facades were preferred more by these experts. However, a similar Q-analysis performed for the laity-group, revealed about the same pattern. Here also half the group founded their preferences on the complexity of the buildings. No other clusters were found.

The conclusion of this finding is that architects as a group do not use other preference criteria than laymen do. Both these main professional clusters preferred the more complex facades and disliked the simpler, poorer exteriors. Thus, there is no evidence for a special classification within the architect group.

The reported discrepancies between the experts and laymen (see previous page) were mainly based on differences in the experience of the exteriors' complexity levels. The architects in fact evaluated some of the simpler buildings as more complex while the laymen evaluated some of the complex buildings as more simple.

Professional categories and Personality

Discrepancies in personal measures between architects and laymen were investigated for all the measures. Only one significant difference between the subject groups could be demonstrated. Architects showed lower trust in their own economic security, as measured by the personal history form ($p=.02$). This judgement might have caused a similar tendency for the experts' more negative experience of basic security ($p=.07$). These findings reveal a rather congruent personal state of both subject groups since no other discrepancies in this respect were shown.

Personality, profession and environmental evaluations

The combination of personal measures with professional categories revealed many but not readily interpretable effects. The dimension of neuroticism for instance was more important for the experts' preference ratings than for the laymen's. Table 18 shows that architects who scored higher on the neuroticism factor generally perceived the exteriors as less pleasant, a relation that was not found for the laymen.

TABLE 18: The evaluations of the exteriors' VALENCY for three neuroticism levels and two professional categories ($N=40$, $p_{int}=.04$).

VALENCY	Neuroticism			M
	low	medium	high	
Architects	4.1	3.5	3.7	3.8
Laymen	3.5	3.6	3.5	3.5
	3.8	3.6	3.6	3.6

Another such curious finding was shown for the professional groups' sociability which seemed to be related to the perception of the exteriors (table 19). For the architects, the persons with medium scores in this measure experienced the buildings as more aged, whereas the laymen with medium scores perceived the houses as less aged.

TABLE 19: The evaluation of the exteriors' AGE for three sociability levels and two professional categories ($N=40$, $p_{int}=.01$).

AGE	Sociability			
	low	medium	high	
Architects	3.8	4.4	3.9	4.0
Laymen	3.8	3.6	4.0	3.8
	3.8	4.0	4.0	3.9

It was also possible to verify the previously noted semantic discrepancies between architects and laymen concerning the definition of scale/mass and age (table 20). Although both subject groups demonstrated about the same mean mass evaluations for both house types, the discrepancies between low- and high-rise houses were dramatically larger for the laymen. In other words, they perceived the low-rise houses as significantly lighter and the high-rise houses as significantly heavier than the architects.

TABLE 20: Semantic evaluations of MASS for two professional categories and two building types (N=40, $p_{int}=.02$).

MASS	Building Type		M
	low rise	high rise	
Architects	3.8	4.9	4.4
Laymen	3.5	5.4	4.5
	3.6	5.2	4.4

A similar relation was found for the experience of the exteriors' age (table 21). While architects hardly discriminated between the two house types, the laymen evaluated the low-rise houses as younger and the high-rise buildings as older than the expert group. These last two findings might support the previously demonstrated discrepancies in semantic language use between the architects and laymen.

TABLE 21: Semantic evaluations of AGE for two professional categories for and building types (N=40, $p_{int}=.001$).

AGE	Building Type		M
	low rise	high rise	
Architects	4.1	4.0	4.0
Laymen	3.4	4.2	3.8
	3.7	4.1	3.9

In a similar way the professional differences with respect to the exteriors' complexity levels were demonstrated. Instead of partitioning the exteriors according to their building type, low- or high-rises, the buildings were divided into categories of low and high complexity. Houses with low-complexity exteriors were generally perceived as less colorful by all subjects, but this connection was more pronounced for the laymen (table 22).

TABLE 22: Semantic evaluations of the buildings' COLOR for two professional groups and two building complexity levels (N=40, $p_{int}=.05$).

COLOR	Exterior Complexity		M
	low	high	
Architects	3.4	4.3	3.9
Laymen	3.2	4.4	3.8
	3.3	4.4	3.8

Table 23 shows the interaction of the facades' complexity and AGE for the two professional groups. Again the complexity affected the laymen's perception more than the architects'.

TABLE 23: Semantic evaluations of the buildings' AGE for two professional groups and two building complexity levels (N=40, $p_{int}=.001$).

AGE	Exterior Complexity		M
	low	high	
Architects	4.5	3.5	4.0
Laymen	4.7	2.9	3.8
	4.6	3.2	3.9

Looking behavior in general

As described earlier, four measures for the subjects' looking behavior were retained as dependent variables. These were: number of fixations per time unit, dispersion of the fixations, saccadic amplitude or length of eye movements, and the relation between the horizontal and vertical components or xy-ratio.

All the measurements, except in one case, demonstrated significant differences between both building types and complexity levels. The one exception was the number of fixations for building types. Low-rise facades were fixated about equally often as high-rise exteriors. Naturally the other three measures were strongly affected by the stimuli's pictorial content. High-rise blocks demonstrated, for instance, a larger dispersion for the eye fixations ($p=.001$), with longer ($p=.001$) and more vertically oriented eye movements ($p=.001$). In similar ways, complex exteriors attracted more fixations ($p=.04$) with larger dispersions ($p=.008$). The eye movements were also shown to be longer ($p=.001$) and more vertically oriented ($p=.001$) for these facades.

An interesting interaction was however found. The least complex high rise exteriors evoked the largest dispersion of fixations ($p=.001$). An explanation for this might come from information theory. These particular stimuli contained relatively little information, spread over a large surface. The individual, in order to find information, had to search for it all over the surface. For the less complex stimuli with smaller surfaces the relation was the contrary. Here the eye very quickly scanned the smaller surface and thus abandoned the more explorative eye movement pattern sooner, resulting in a more concentrated eye fixation pattern.

All subjects' eye fixations were plotted for all stimuli and different frequency plots were generated in order to demonstrate what specific building details were most looked at. Like in the first study (I) it was found that entries and window openings were the most looked at building parts. Some interesting differences between the low-rise and high-rise buildings were found. For these plot analyses however, all described relations are discriminated by visual comparison since no formal statistical analysis is applicable here.

For the low-rise houses, the eye always seemed attracted by the entries. Door openings were clearly used as resting points. Since the high-rise exteriors had no entrance parts visible, the eye obviously concentrated more on window and balcony openings. However, since no natural gravity point was visible, as with the low-rise houses' entries, these fixations on windows became rather random. Another discrepancy between the two building types was the so called around-the-corner effect for the low-rise facades. People seemed to search for more information on the structures outlines at the normal eye level. Evidently this behavior was not used on the high rise stimuli since they did not have any outlines visible.

Another general finding was that the lower parts of the stimuli were looked at more frequently than the upper regions. Also the right side was generally observed more than the left, especially by the experts. The most looked at surfaces were the complex, colorful ones. The least fixations were attracted by large, empty, uniform and coherent surfaces, these being either wall or roof surfaces.

Looking behavior and personal measures

Some discrepancies between the experimental subjects for the four measurements on looking behavior were related to their scores on certain personal measures. Extroversion was shown to be related to the number of eye fixations (table 24). Individuals with a higher level of extroversion demonstrated a somewhat lower number of fixations.

TABLE 24: Number of eye fixations for three levels of extroversion and two professional groups (N=40, p int=.05).

NUMBER OF FIXATIONS	Extroversion			
	low	medium	high	
Architects	2.52	2.90	2.30	2.57
Laymen	2.82	2.57	2.54	2.64
	2.67	2.74	2.42	2.61

Concerning the attitudes inventory, rationality was related to the dispersion of the eye fixations (table 25). Subjects who were more rational spread their fixations less than the irrational persons did.

TABLE 25: Dispersion of eye fixations for three rationality levels and two professional categories (N=40, p int=.03).

DISPERSION OF FIXATIONS	Rationality			M
	low	medium	high	
Architects	11.16	8.47	10.48	10.04
Laymen	10.94	10.46	10.14	10.51
	11.05	9.46	10.31	10.27

Another approach of interest for looking behavior studies focuses on the individual scanning strategies. Assumptions have been made about human looking behavior being strongly affected by individual characteristics, such as training, personality and so on (Abercrombie, 1960, Noton & Stark, 1971). Similar scanning patterns should thus be demonstrated by individuals with similar traits. In this experiment the individual scanning paths were generated for all subjects' five first fixations for each stimulus, all together 960 cases. It was hoped that some general scanning patterns would be demonstrated.

Apart from the finding that these first five fixations, as in the previous experiment on eye movement behavior, gave a fair indication of the pictures' visual attention centra, no general behavior classification could be made, neither of the experimental subjects nor the stimuli. This finding supports the assumption that scanning paths as measured in this study are unique and novel for each situation (Mackworth & Bruner, 1970).

Looking behavior and professional differences

The four looking behavior measurements were also used to demonstrate differences between the two professional groups (table 26). Some discrepancies can be noted. The

architects had fewer fixations ($p=.03$), although most of the difference can be ascribed to the low-rise buildings. They also had more concentrated eye fixations ($p=.03$) on the low-rise buildings. Finally, the architects tended towards longer eye movements ($p=.08$) and these were more vertically oriented than the laymen on the high-rise buildings ($p=.10$).

TABLE 26: Mean looking behavior measures for two building types and the two professional categories (N=40).

	Number of Fixations		Dispersion Fixations		Saccadic Amplitude		XY Ratio	
	low	high	low	high	low	high	low	high
	rise		rise		rise		rise	
Architects	2.53	2.56	9.65	10.76	9.90	10.35	3.28	2.27
Laymen	2.67	2.59	10.27	10.77	9.83	10.22	3.24	1.89
	2.61	2.58	9.96	10.76	9.86	10.29	3.26	2.08

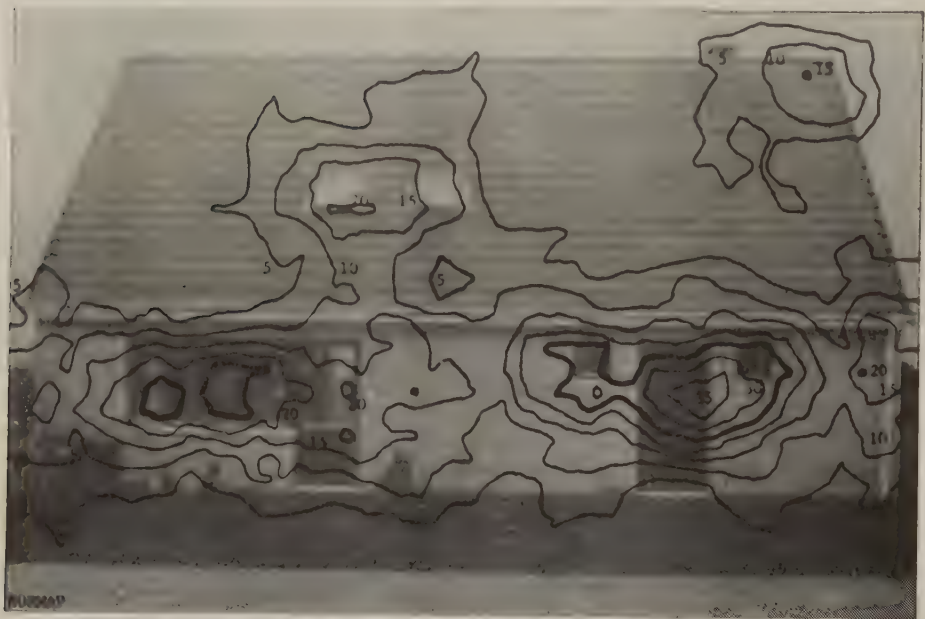
One of the most interesting assessments of the looking behavior in this study was the frequency plotting of all eye fixations upon the building exteriors. By making plots for architects and laymen separately, differences between the two groups in visual attraction centra were investigated. These frequency plots were made in the form of isorithm charts for all the buildings and both subject groups by means of a computer program (Nordbeck, 1972,1973).

Plate 7 shows the representations of two building exteriors with the eye fixations for both the architects and the laymen. These pictures were selected because they represent the stimuli which caused the largest discrepancies between the two professional groups. As can be seen, no large differences are discernable. Architects and laymen looked at about the same parts and details. Since the laymen generally had a higher number of fixations, the slight discrepancy between the two groups that can be seen might be ascribed to this fact.

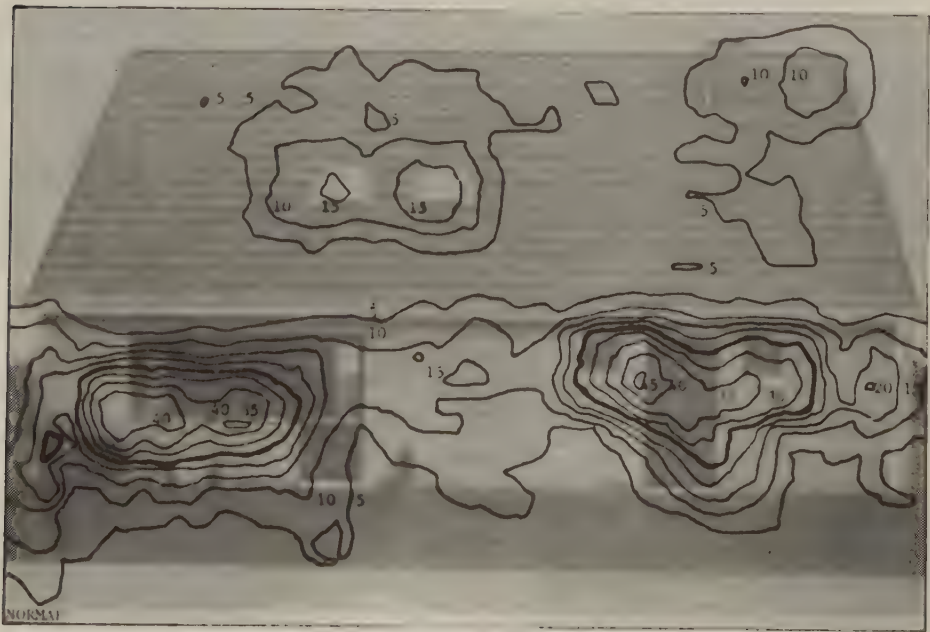
Looking behavior and environmental evaluation

Eye movement measurements were also used as personal measures, i.e. describing the individual subjects. As already mentioned, only one measure served this purpose. The saccadic amplitude or length of the eye movements was retained as an independent variable and the subjects were partitioned according to this measure into subgroups, one with short, one with medium and one with long eye movements.

PLATE 7: Eye fixations plotted for architects (top) and laymen (bottom) for buildings 19 and 20.



Building 19: Eye fixations plotted for architects (n=20).

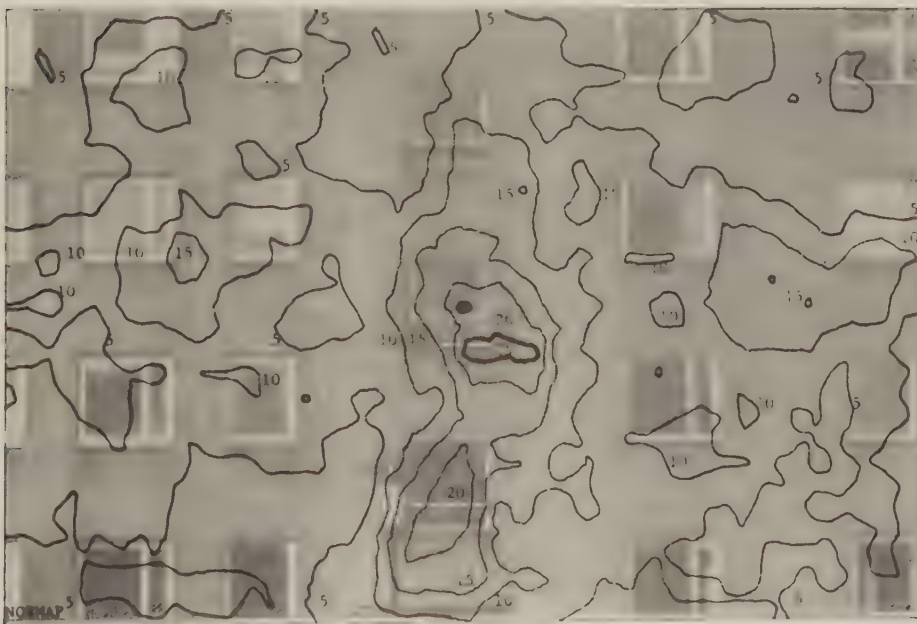


Building 19: Eye fixations plotted for laymen (n=20).

PLATE 7: (cont)



Building 20: Eye fixations plotted for architects (n=20).



Building 20: Eye fixations plotted for laymen (n=20).

As usual in this study, only interactive effects could be ascertained. It was for instance shown that people with generally long eye movements had a larger fixation dispersion on high-rise than on low-rise buildings ($p=.04$). This relation was not found for individuals with short eye movements.

Environmental evaluation was also related to some degree to the length of the eye movements. A significant effect was demonstrated for the form dimension. Architects with shorter eye movements experienced the exteriors as more rounded while the laymen with short eye movements perceived the same houses as more angular (table 27).

TABLE 27: The evaluations of the exteriors' FORM for three levels of saccadic amplitude and two professional categories ($N=40$, $p_{int}=.005$).

FORM	Saccadic Amplitude			M
	long	medium	short	
Architects	4.0	4.3	4.4	4.2
Laymen	4.4	4.5	4.1	4.3
	4.2	4.4	4.2	4.3

A curious tendency revealed that people with longer eye movements perceived the facades generally as more positive, higher in valency ($p=.10$). Or vice versa, the experience of valency might have affected the length of the eye movements.

DISCUSSION

In this study it was assumed that effects of professional training and personal measures on environmental evaluation and behavior, such as eye movements, would be found.

The assumed discrepancies in general environmental evaluation or looking behavior were not demonstrated between architectural experts and laymen. Certainly it was shown that the architects used a semantically different language for the description of the presented buildings and a somewhat deviating eye movement behavior, but in general terms these discrepancies were smaller than the ones found for instance, between different personality subgroups.

As for professional preferences, some discrepancies were demonstrated. It was shown that architects generally liked simpler, plainer and more coherent facades, without too much decoration or detail. Laymen on the other hand preferred lavishly outfitted and furnished exteriors, preferably with a touch of antiqueness.

The assumption that architects would reveal a personality pattern which deviates from laymen was not supported. The only difference in this respect was a somewhat lower economic security for the architect group, probably owing to the declining building market and its effect upon the job market for architects.

In the previous study (II), several relationships between personal measures and the perception of building exteriors were demonstrated. In this study many connections between personal and environmental measures were also shown. However, only a few corresponding results from both studies are statistically significant. The explanation of this failure probably has to be found in the homogeneous structure of the subject samples used. Older and experienced academic professionals are apparently rather alike but different from first year architecture students.

Part of the results concerning the connections between personality and semantic evaluations were not meaningfully interpretable. However, some of these uninterpretable results were presented for the sake of curiosity and thoroughness.

As can be seen from the results on looking behavior, many findings trying to relate eye movements to the personal measures are not readily interpretable. Any meaningful connections between eye movement behavior, personality and evaluation have to date not been clearly shown. However, the use of the eye movement technique was justified by those

results which were interpretable, e.g. eye fixation frequency plots, illustrating the exteriors' most looked at parts and details and the small but significant discrepancy between architects and laymen for some of the generated measures.

These differences in eye movement behavior might be ascribed to the architects greater acquaintance with building facades. They are probably quicker to find what they are looking for. On the whole, both subject groups looked at the same details to about the same extent and the same order, even if the laymen used a little more time in this respect. As in the first study, the most looked at parts of the exteriors were shown to be entry and window details. The least looked at parts were plain and empty large surfaces with no details. The implications of these results are discussed in the next chapter.

chapter 5 : Discussion

METHODOLOGICAL COMMENTS

All scientific measurement implies more or less severe simplifications of reality. Especially within the field of environmental psychology, the objects for scientific research are extremely complicated. The main topic in the present work, the human perception of the built environment, thus involves a forbidding number of factors and possible assessments. We are still in the beginning of our investigations on human experience and perception.

In this work some classic and some more or less well proven scientific methods were used for the assessments of the different measures. By combining different types of methods and comparing their results, an attempt was made to grasp the problems as differentiated and completely as possible within the frame of the available resources. Still, the forms and limitations of two of the main methods may need some comments.

As already indicated, the value of semantic ratings as measurements of experiences might be justified by the fact that scientific results always have to be communicated verbally at some stage. The verbal interference has to be accounted for sooner or later. The problem of what is communicated and how it is understood and interpreted certainly not only applies to experimental situations. One clear advantage of the semantic method is its ease of administration and in the interpretation of the findings. The drawback concerning the uncertainty of what exactly is measured is not typical for this method alone. The interpretation of the semantic dimensions' is dependent on subjective evaluations. These interpretations can be made more certain by the use of more variables. In the present experiments, an attempt was made to find a proper balance between certainty and utility, resulting in a moderate number of variables, assigned to each environmental dimension.

The use of eye movements as both individual and environmental assessments has to the author's knowledge not been practiced before. It is obvious that this strictly individual trait, as has been shown, also gives good information about the stimuli's visual significance in different aspects.

Like the use of semantic ratings, the technical construct of the laboratory situation has certainly had some limiting effect on the results from the eye movement registrations. It was however hoped that the combination of this measurement with verbal assessments would remove some of the method's uncertainty. The potential of the eye movements as an indication of the visual gravity, and about which parts of the buildings were most looked at is indisputable. The the arguments against laboratory experiments of this kind are contradicted by the stable, repeatable and meaningful results obtained. Similar conclusions are also found in several other investigations Mackworth & Bruner, 1970, Mackworth & Morandi, 1967, Yarbus, 1967).

On the other hand the measurement did not function as a very good 'person-related' variable, i.e. as a means to assess and compare individuals' evaluations of the environment. Only the saccadic amplitude, or mean lengths of eye movement, was useful as a personal trait. However, on the whole, it can be concluded that eye movement registrations, as performed and analyzed here, are powerful measurements of the visual gravity centers in pictorial stimuli. They provide very stable location indications for eye fixations and these results are generally easy to interpret.

EVALUATION OF BUILDING EXTERIORS

The perception of the environment's pleasantness or valency, as defined in the present studies, might be regarded as a major criterion of evaluation. In terms of Moles' information theory of aesthetic experience, this evaluation clearly belongs to the environment's aesthetic, as opposed to the semantic, information. In terms of Sandström's (1979) theory on aesthetic visual experience, this perception should be assigned to the sensuous level of the experience. Being a main interest to environmental psychology research, the individual's feeling of comfort and stimulation has been the dominating topic for this investigation. An attempt was made to relate this type of experience to other variables, both within the observed buildings and within the observers themselves.

Pleasantness and Legibility

One important assumption for the present work was the connection between perceived pleasantness and experienced legibility. Specifically, it was felt that the individual's ease of identifying the function of a specific building would affect the perceived pleasantness of the building. No such clear relation existed. The ease of identification was in fact not connected with any of the environmental dimensions used. However, there was some support for the conclusion that the most pleasant buildings were those which expressed their function to a similar extent. Buildings that were too hard or easy to identify were perceived as less pleasant. This conclusion gives no argument for an unlimited increase of the environment's legibility, if the aim is to enhance the individuals' feelings of comfort and pleasantness. A certain amount of mystery and unpredictability might in fact be appreciated (Rapoport & Kantor, 1967).

Pleasantness and Building Type

Many housing environments contain both low- and high-rise buildings. In their own way they express different messages, political, economic, social, etc. These building types are evaluated differently, especially with regard to dwelling facilities. In the last experiment it was tempting to examine how these two types of building forms were perceived in relation to each other. Although the presentation forms did not correspond completely - the high-rise houses were presented only in part - the findings might have some significance for the understanding of the obtained discrepancies in evaluation.

As expected, high-rise blocks were generally perceived as less pleasant. It must be kept in mind that the buildings represented dwelling facilities which were obviously located in typical housing or suburban environments. Downtown blocks are probably perceived somewhat more positively. There was however no general disliking of the high-rise buildings as such. In fact, a few of the high-rise structures were perceived as very pleasant. These building exteriors (building 14 and 22 in study III) were characterized by a high degree of complexity (Janssens, 1984). In other words, it seems as if the high-rise structures in general were experienced as less pleasant because they were lower in complexity.

Pleasantness and Age

Buildings perceived as older are generally ascribed high affection values, newer ones only very seldom. Designers may however try to build these values into new structures as well. By taking into account traditional building techniques and forms, the buildings might express an older age than they actually have. Architects might have different opinions about this lack of architectonic 'truth', but the fact remains that the human animal is a creature of habit, needing old values in order to be able to assimilate new expressions. As the original old environment gets demolished, the need arises for the artificial, imitating style, despised by many architects. In all the experiments, it was found that building exteriors perceived as old by the subjects, also were more pleasant and stimulating. Certainly some newer houses were equally liked, especially by the architect group, but the general tendency was clear. These findings might be of importance, especially for the completion or 'fill in' of older urban environments (Groat, 1984).

Pleasantness and Complexity

Building exteriors might represent a wide range of complexity levels. In other perceptual research (Berlyne & Crozier, 1971), it was found that appreciation of structures will increase with increasing complexity, until a certain threshold is reached. Then the appreciation will quickly decrease again. The results obtained here give no reason to question these previous findings.

It was demonstrated how, in most cases anyway, the facades perceived as most complex, were also experienced as most pleasant. It was even established that large subgroups were basing their preferences directly on the stimuli's perceived complexity. However, for exteriors with very extreme complexity levels, the connection was no longer clearly linear. Here, the introduction of the structures'

unity seemed to be important as well. Since high complexity sometimes can be found together with high unity, the previous assumption on the complexity threshold might need to be somewhat extended. Facilitating the processing of highly complex information by introducing high unity will increase the threshold of appreciation. This conclusion is in support of information theory, in terms of redundancy and message. However, the building exteriors presented in these studies were seldom so complex as to be devalued for this reason. The assumptions mentioned above are thus based on a rather small sample of stimuli and need further investigation.

The importance of the experienced complexity for the appreciation of the built environment might be illustrated by the following figures. Based on the results of the three reported studies, the connection between complexity and pleasantness/valency on one hand and some of the other building properties on the other, can be represented in the following way. The darker areas in the graphs might be interpreted as more pleasant and stimulating.

FIGURE 4: Perceived Pleasantness for different levels of environmental complexity, unity, age, and building rise.



EVALUATION AND PERSONALITY

The assessment of individual characteristics in the last two studies demonstrates the effect of these measures on environmental perception. Some of the connections might be of considerable importance for the communication between architecture and observer or between different groups of observers.

It might be important to stress once again that the studies were carried out under rather homogeneous conditions, i.e. both the subjects and stimuli were rather similar in many respects. This might have affected the results in a moderating way. More varied groups of subjects and stimuli should therefore be assessed in future experiments in order to give a more general picture of the obtained interactions.

Self-report Measures

The subjects in the last two studies were assessed by seven different tests, including measures of 25 personal dimensions (see table 1, p 21). As already mentioned, most of these measures were related to some of the environmental evaluations. Most of these connections had to be explained in terms of interactions, thus obstructing clear and simple conclusions. However, an attempt has been made throughout the descriptions of the studies, as in this discussion, to concentrate on some of the more simple and relevant connections.

The most interesting connections were found with the Eysenck Personality Inventory. Both extroversion and neuroticism were affecting the experience of the buildings. Extroversion generally affected the perception of the building's complexity. Contra to expectations, it was found that individuals who tended to the extrovert side perceived the exteriors as more complex, structured and, articulated. Since the information rate of building facades might be increased by their complexity, the subjects asking for more information obviously also found more information. In terms of the Kuller activation model, this might be seen as a typical compensatory behavior. If one needs much complexity, one finds it. It might also be explained as a methodological weakness. The extroversion trait is evidently composed of two different components: one concept of sociability and one of impulsivity. The subjects might have responded more to one of the concepts, thus giving a somewhat skewed interpretation of the dimension as such.

The state of neuroticism affected the perception of building exteriors in another way. People with high scores on this dimension generally perceived the exteriors as larger in scale and mass. This was especially true for

facades that were experienced as more modern. If it is true that large, heavy buildings are seen as more threatening than small ones, this might help explain this personal reaction. People with neurotic tendencies also perceived large, heavy houses as less pleasant. This was also suggested by their evaluation of the large, newly built department store in study II.

The dimensions of the Arousal Seeking Tendency test did not reveal any significant general effects. However some tendencies are worthy of mention. Individuals who were dependent on stimulation from the surrounding - arousal by sensuality - generally judged the built environment as lower in originality and pleasantness. This finding is in concordance with the expected behavior, since the stimuli used in these experiments were not very stimulating.

The person's social situation had a rather important effect on the perception of buildings. People with a more stable social situation perceived the buildings as smaller in scale. Persons with a well organized social situation perceived the buildings generally as more pleasant, more coherent and more potent. A weak, but interesting tendency was that people who judged their own social environment to be friendly also experienced the built environment as more pleasant. The perception of one's own social situation thus seemed to directly affect the perception of the built environment.

The three dimensions assessed by the attitudes form also had some effect on a person's environmental perception. This was especially the case for social conservatism. Conservative people perceived the buildings generally as more positive, smaller in scale and more articulated, or more complex. The last finding however was not found in the third study since the conservative laymen perceived the exteriors as lower in complexity. This discrepancy might be explained by the difference in overall conservatism level between the subject groups. The professional groups in the last experiment were more conservative than the first year students in the second study.

The personal history also showed some effects on the evaluations. People's basic security seemed to affect their perception of the buildings' mass, scale and complexity. The more secure one felt, the smaller, less complex and less massive the buildings were perceived. Also, people who had a secure economic situation perceived the built environment as more loaded with affection. An interesting connection between one's own dwelling situation and the perception of the buildings was also demonstrated. People who felt more pleased with their own dwelling also seemed to perceive other buildings as more positive.

In summary, it can be said with considerable confidence that one of the main causes of individual discrepancies in environmental evaluations might be found in the individual's own feelings of security, balance and comfort. People who felt more at ease with their own situation in different respects generally gave more positive evaluations of the built environment.

Percept-genetic Measures and Looking Behavior

Finally, the results from the creativity test and looking behavior did not reveal any significant effects on the evaluation of the building exteriors. It must be said that these measures did not discriminate strongly between the experimental subjects. As stated earlier, this might depend on a too harsh simplification of these measurements or a too homogeneous sampling structure. However, one plausible explanation might be that there simply were no effects present. Still, a weak connection between perceived pleasantness and saccadic amplitude was demonstrated ($p=.10$). Persons with longer eye movements evaluated the building exteriors as more pleasant and interesting.

LOOKING BEHAVIOR

The first glance

Love at first sight! The results seem to show that the first glance is the most important for the overall experience of the whole facade. The peripheral sight is apparently able to gather enough information to make a rather thorough judgement of the visual stimulus' different properties (Mackworth & Morandi, 1967). Even if a facade is presented for a very short period, so that only a few fixations can occur, the observer can give a good description of the building. In the same manner, analyses of long lasting eye tracking patterns show the importance of the very first fixations. They become decisive for the whole pattern. This means, the eye in principle repeats the initial movements, possibly with some extensions. Generally the eye has an enormous faculty for the fast localization of the most important centers of attention in the visual field. Very rarely are large deviations from the original pattern performed.

Eye Movements and built environment

The presentations of the entire street environments (see study I, p 31, and appendix 1) were used in order to provide an impression of the eye movement behavior for more general built environments. Although the registrations were not analyzed with the same accuracy as the responses to the other stimuli (the ten isolated building exteriors), some important conclusions were justified. It was found that the eye showed a clear tendency to follow the perspective directions in the pictures. From the nearest buildings the eye moved stepwise to the sight point, farthest away, and then back. The most looked at fields in these situations were generally the sight points and the entries and windows of the nearest buildings.

Even the presence of strange uncommon details such as antique lightposts, brightly colored postboxes or 'strange' house forms, affected the eye movements in so far that these parts in general received more and longer fixations.

It must be pointed out that the presence of human beings in the visual field strongly affected the eye tracking pattern. Even if the experimental subjects were asked to look only at the built environment, their eyes could not ignore these social objects; the persons in the picture were examined again and again.

Eye Movements and facades

About the same pattern was found for eye movement behavior for isolated houses. Here also the eyes moved first to the nearest corner, wandered more to the deeper, farther parts and then returned to the beginning points. The eyes found quickly the more important information bearing parts of the building exterior: entry and windows. When the fast inventory had been performed, the more thorough examination of that which had been seen previously dominated the looking, eventually extending to include some new discoveries and details.

The findings from the eye movement analyses indicated that the most looked at parts of building facades are by far the entries and windows. The reason for this might be that the subjects expected to find the necessary information there. The implications for the designing of building exteriors thus has to be that important information will be best communicated by these building parts. The more a building detail is fixated, the more probable it is that messages will be detected (Antes, 1977, Nelson & Loftus, 1980). A similar preference was found for the building's outlines on normal eye level. The subjects seemed to try to look around the corners, indicating another important kind of visual attraction, as if trying to collect hidden information. This is not due to a general interest for outlines as such. The outlines located on normal eye level will generally be fixated much more than roof outlines or details on the buildings' foundations. This is understandable since one looks for new information where it most likely to be found, i.e. on the normal eye level.

As a whole, roof surfaces were not looked at as much as has been previously assumed. Normal roofs very seldom contain specific details or parts. The perceptual value of the roof as such may instead be found on the symbolic level.

The most looked at field of the building facade is the part that is at normal eye level. Certainly, the eyes look upwards too for high-rise buildings, but most fixations are generally concentrated on the lower parts of the buildings. One explanation for this might be the presence of an entry, since entries are the specific parts which are looked at most. If a building without a visible entry is viewed, the eyes wander around more or less aimlessly, certainly searching for particular details, windows and so on, but the presence of an entry seems to provide the eye with a resting point. The eye movement behavior apparently becomes more stable and balanced when a distinct entry can be discerned. This is probably especially true for larger and public edifices. When it concerns low-rise dwellings, the visual weight of the entry might not be that important, since the informational requirements can be satisfied by the windows, e.g., who is living here?

This makes it complicated to demonstrate unambiguously what isolated parts of a building are more important than others when it concerns eye movement behavior. It can be stated that darker mural openings as well as clear colors on particular details more often attracted the eyes.

Generally the eye was attracted by complex, varied, colorful and bright textures, rather than by empty, simple, poor and dull surfaces. However, a discriminating small spot on an otherwise empty surface attracted the eye more than when it was placed in more complex surroundings. For instance, a small ventilation hood on a tiled roof was more fixated than a similar ventilation shutter on the more articulated facade wall. In other words, the same information was more easily detected in a high redundancy environment with low complexity. Contrast in colors increased the complexity level and decreased the redundancy content of an exterior's surface. These conclusions are supported by information theory and are well known by skilled designers. Still, one can find many examples of the non-application of these self-evident facts.

PROFESSIONAL DIFFERENCES

Profession and Evaluation

A superficial interpretation of the results was that the experts preferred less complex facades, more austere and pure in formal expression. The analysis of the results within each group however revealed that both experts and laymen mainly based their preferences on the exteriors' complexity. Apparently experts and laymen deviated in their perception of environmental complexity. Architects rated some exteriors as more complex than the laymen did.

An inspection of these specific exteriors revealed that the laymen were closest to the common concept of complexity in their ratings. If complexity is described by bits of information, as suggested by the concept of 'information rate', then architects definitely have a deviating concept of environmental complexity (see Berlyne, 1964). This argument would result in the assumption that professional discrepancies might be based on conceptual differences, which in turn might explain environmental preference discrepancies. This assumption is in concordance with the finding of professional discrepancies with respect to semantic ratings. Architects may 'look through' superficial complexity in the form of decorations and furnishment. Laymen may not do so. Evidently, this ability is refined by professional education, training and experience.

Profession and Personality

As a group the architects showed the same personal profiles as the chemical engineers. Only one significant discrepancy between architects and laymen with respect to the personal measures could be established. This concerned their feeling of economic security. This difference might be explained by the declining trend in the building field, thus causing a harder and more stressed labor market for all building professionals.

The assumption that architects are recruited from a special individual sample with specific personality traits was not supported. On the contrary, the architect group was highly comparable to the group of chemical engineers.

Profession and Eye Movements

It was assumed that architectural experts and laymen would demonstrate different looking behaviors when inspecting building exteriors. By their training, architects were hypothesized to have acquired special perceptual skills which in turn would affect the emotive experience of the built environment.

The analysis of the eye movements of both architects and laymen did not demonstrate any major discrepancies. The architects showed somewhat fewer eye fixations per time unit and these were generally more concentrated in the visual field. This difference was explained in terms of exploratory stages. The architects sooner found what they were looking for, thus abandoning quicker the first inventory stage for the more thorough inspection stage with generally slower and even more concentrated eye movements.

There were however only small differences when it concerned the nature of the most looked at parts of the buildings for the both observer groups. Both experts and laymen looked at the same building parts in about the same extent. Both entries and windows were most looked at by both subject groups, even if it seemed to take somewhat longer time for the laymen to find these eye attracting spots.

PRACTICAL IMPLICATIONS

On the whole, it is assumed that people are different and that taste is every man's own business. Planning the built environment might be ascertained in two ways: either by giving the public what the public asks for, or by playing the role of the educating expert, trying to affect specific or more general developments. Both design strategies might be helped by knowledge on how different people react to architectural objects. An attempt was made here to supply the scientific evidence for some more or less common assumptions.

Architects may advocate a maximal legibility in the architectonic environment, based on architectural means. It was shown here that this demand might not be true for the whole legibility scale. Some evidence was found that environments that are too easy to read might be perceived as boring, just like too ambiguous surroundings.

It is also assumed by many building experts that too high complexity in the built environment should be avoided. The findings clearly show, not only that this high level of complexity is rarely found in everyday Swedish environments, but also that many experts might have somewhat particular concepts of complexity, as compared to ordinary laymen. The architects preference for undecorated plain exteriors was obviously not shared by the lay group.

It must be in the interest of every creative architect to get information on how specific messages in the actual design are read and understood. The intuitive interpretation of these processes has been partly clarified by the experiments on eye movement behavior. The human eye has shown to be astonishingly fast in finding the environment's most important information signs.

The systematic study of looking behavior for everyday situations, such as the buildings presented here, gave a fair insight into the complexity of the perceptual communication process between building exteriors and individual observers. It was found that each situation evoked its own looking behavior with only a few general common characteristics.

The results suggest a greater articulation at the low level of the facades and a gradual decreasing complexity towards the roof, unless of course, there are reasons to try to lift the observer's eye. The impact of specific environmental qualities such as unexpected forms and colors, was clearly demonstrated in addition to the visual importance of entries and windows. These findings might ask for a more careful design of such specific building parts.

CONCLUSIONS

The present work was based on the use of several experimental methods, mainly emanating from the fields of psychology and environmental psychology. Apart from classic self-report measures, such as EPI, less traditional measures such as the AST, Social Situation form and the percept-genetic technique were used. New methods were also generated as a part of this work, the forms on Socio-cultural Attitudes and on Personal History. In addition other measures were used: verbal reports, semantic environmental ratings, looking time and eye movement registrations. The measures obtained were divided into both subjective and more objective assessments. An attempt was made to relate all these methods' results to each other.

The main results may be summarized as a general demand for more environmental complexity and a moderate increase of the built environment's legibility, the strong relationship between the buildings' perceived pleasantness and expressiveness point in this direction. Both these findings are in good concordance with the general information theory model described earlier. On the other hand, it was shown that personal factors are important for the environmental experience. Both the individual's personality, his social situation and various background variables, such as profession, were found to affect the perception of the buildings. These findings are in turn in agreement with the activation theory model, where the interaction of all these factors is assumed to affect the individual's emotive well-being.

The professional training of architects did not affect their environmental evaluations or looking behavior as dramatically as expected. Only minor, but important, differences from academic laymen were found. The results indicated that specific personality traits such as extroversion or basic security might be more important for environmental evaluation than the professional categorization per se.

As for the future of this problem field, a few obvious points of attack might be outlined. The most important one might be to extend the studies to more diversified samples of both experimental subjects and stimuli. There is strong support for the assumption that the subject samples used in this work are not representative of a large general public. The academic occupations of the individuals certainly had homogenizing impact on the results obtained. A more general sampling of environments is also recommended for the validation of the presented results.

References

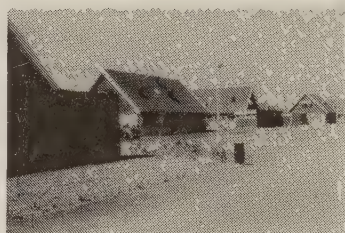
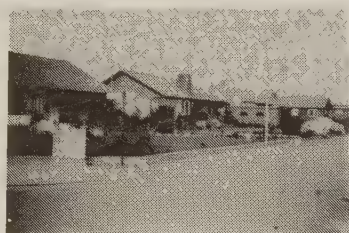
- Abercrombie, J M L, 1960, *The Anatomy of Judgment*, Hutchinson, London.
- Acking, C-A, 1972, Arkitekturens dilemma, AT-tidningen 6/72, Stockholm.
- Acking, C-A, et al., 1974, *Semiotik*, Hufo/Formlära, LTH-A, Lund.
- Allport, G W, Vernon, P E, Lindzey, G, 1959, *A study of values*, Houghton Mifflin, Boston.
- Antes, J R, 1977, Recognizing and localizing features in brief picture presentations, *Memory and Cognition*, 5.
- Appleyard, D, 1970, Styles and methods of structuring a city, *Environment and Behavior*, 2.
- Berlyne, D E, 1961, Conflict and the orientation reaction, *J.exp. Psychol.* 62(5).
- Berlyne, D E, et al., 1967, Effects of auditory pitch and complexity on EEG desynchronization and on verbally expressed judgements, *Canad. Journ. of Psychol.*, 21(4).
- Berlyne, D E, 1971, *Aesthetics and Psychobiology*, ACC, New York.
- Berlyne, D E, Crozier, J B, 1971, Effects of complexity and pre-choice stimulation on exploratory choice, *Perception and Psychophysics*, 9.
- Berlyne, D E, 1974, *Studies in the new experimental Aesthetics*, Hemisphere Publishing Corporation, Washington.
- Buswell, G T, 1935, *How people look at pictures*, University of Chicago Press, Chicago.
- Canter, D, 1974, *Psychology for Architects*, Applied Science Publishers Ltd, London.
- Craik, K H, 1975, Individual variations in landscape description, in Zube et al., *Landscape assessment*, Dowden, Hutchinson & Ross, Stroudsburg.
- Davidoff, J B, 1975, *Differences in Visual Perception*, Academic Press, New York.

- Dixon, W J, 1970, BMD, Biomedical Computer Programs, X-series Complement, University of California Press, Berkeley.
- Dixon, W J, 1981, BMDP Statistical Software, University of California Press, Berkeley, Los Angeles, London.
- Eysenck, H J, Eysenck, S B G, 1964, Manual of the Eysenck Personality Inventory, University of London Press, London.
- Eysenck, H J, 1973, Eysenck on Extraversion, Halsted Press, New York.
- Groat, L N, 1984, Strategies for contextual Design: a partial order scalogram analysis, unpublished paper, presented at the 8th IAPS Conference, Berlin.
- Hesselgren, S, 1969, The Language of Architecture, Student-litteratur, Lund.
- Janssens, J, 1976, Hur man betraktar och identifierar byggnadsexteriörer - methodstudy, Formlära, LTH-A, Lund.
- Janssens, J, 1981, Personlighet, socio-kulturell bakgrund och attityder till byggnadsexteriörer, Formlära och Miljöpsychology, LTH-A, Lund.
- Janssens, J, 1984, Skillnader mellan arkitekter och lekmän vid betraktande av byggnadsexteriörer, Formlära och Miljöpsychology, LTH-A, Lund.
- Kroeber-Riel, W, 1980, Konsumentverhalten, Vahlen-Verlag, Munchen.
- Kuller, R, 1972, A semantic model for describing perceived environment, National Swedish Building Research, D 12:1972, Stockholm.
- Kuller, R, 1975b, Semantisk miljöbeskrivning. (SMB), Psykologiförlaget ab, Stockholm.
- Kuller, R, 1975, Tåt-lågt, en kommentar, i Edberg och Eriksson, Gruppen för Arkitektur- och Miljöpsykologi, Symposium nr 4, KTH, Stockholm.
- Kuller, R, 1976, Tillblivelsen av en forskningsmodell- personliga synpunkter på arkitekturpsykologisk forskning, i Gruppen för Arkitektur och Miljöpsykologi/BFR, Formlära, CTH, Göteborg.
- Kuller, R, 1977, Ett test för att mäta intresse för variation, opublicerad stencil, School of Architecture, Lund.

- Kuller, R, 1978, Fartygsmiljöns aktiveringsgrad - en omgivningspsykologisk analys, Formlära, LTH, Lund.
- Locher, P J, Nodine, C F, 1973, Influence of stimulus symmetri on visual scanning patterns, Perception & Psychophysics, Vol 13, No 3.
- Mackinnon, D W, 1962, The personality correlates of creativity; a study of American architects, Proc. XIV Intern. Congr. appl. Psycholog., Munksgaard, Copenhagen.
- Mackworth, N H, Bruner, J S, 1970, How Adults and Children Search and Recognize Pictures, Human Develop., No 13.
- Mehrabian, A, Russell, J A, 1974, An approach to environmental psychology, The MIT Press, Cambridge, Ma, London.
- Moles, A, 1966, (1958), Information Theory and Esthetic Perception, University of Illinois Press, Urbana and London.
- Morris, C W, 1938, Foundations of the Theory of Signs, International Encyclopedia of Unified Science, Vol I, No 2
- Nelson, W W, Loftus, G R, 1980, The functional visual field during picture viewing, Journ. of Exper. Psychol., 8.
- Norberg-Schulz, C, 1965, Intentions in Architecture, The MIT Press, Cambridge, Massachusetts.
- Nordbeck, S, Rystedt, B, 1972, Computer Cartography, Studentlitteratur, Lund.
- Nordbeck, S, 1973, Normap manual, Studentlitteratur, Lund.
- Noton, D, Stark, L, 1971, Eye Movements and Visual Perception, Scientific American, June.
- Osgood, C E, Suci, G J, Tannenbaum, P H, 1957, The Measurement of Meaning, University of Illinois Press, Urbana.
- Prak, N L, 1968, The Language of Architecture, The Hague, Paris.
- Prak, N L, van Wegen, H B R, 1974, De invloed van cognitieve factoren op de perceptie van gebouwen, Centrum voor Architectuuronderzoek, Delft.
- Prak, N L, 1984, Architects: the Noted and the Ignored, John Wiley & Sons, New York.
- Rapoport, A, Kantor, R E, 1967, Complexity and Ambiguity in Environmental Design, Journal of the American Institute of Planners, July.

- Rapoport, A, 1982, The Meaning of the Built Environment, Sage Publications, London.
- Sandström, S, 1979, Teori om estetisk synupplevelse, Institut. för Konstvetenskap, Lund
- Schneider, G, 1969, Two visual systems, Science, 163.
- Senders, J W, Fisher, D F, Monty, R E, ed, 1978, Eye Movements and the Higher Psychological Functions, Lawrence Erlbaum Associates, Hillsdale, New Jersey.
- Smith, G J W, Danielsson, A, 1976, A new type of instrument, constructed to explore the generative qualities of perception, Psychological Research Bulletin, Lund University, Lund.
- Smith, G J W, Danielsson, A, 1978, Richness in ideas, ego-involvement and efficiency in a group of scientists and humanists, Psychological Research Bulletin, Lund University, Lund.
- Sorte, G J, 1981, Visuellt urskiljbara egenskaper hos föremål i den byggda miljön, unpublished paper, see Sorte, 1982.
- Sorte, G J, 1982, Visuellt urskiljbara egenskaper hos föremål i den byggda miljön, Byggforskningsrådet, Stockholm.
- Thomas, E L, 1968, Movements of the Eye, Scientific American, August.
- Yarbus, A L, 1967, Eye Movements and Vision, Plenum Press, New York.
- Zube, E H, Pitt, D G, Andersson, T W, 1975, Perception and prediction of scenic resource values of the northeast, in Zube et al., Landscape assessment, Dowden, Hutchinson & Ross, Stroudsburg.

APPENDIX 1: The 15 street environments, used as additional stimuli in study I.



APPENDIX 2: The eight environmental descriptive dimensions (Kuller, 1972).

The following interpretations are given by the author
(Kuller, 1979):

Pleasantness might be considered as a projection on to the environment of an evaluation process (based on three crude values: good, harmless and bad) refined into what is commonly known as the hedonic or evaluative dimension. This factor parallels Osgood's Evaluation factor (1957) and also the Hedonic Value reported by Berlyne 1971.
Variables: boring, brutal, good, idyllic, pleasant, secure, stimulating, ugly.

Complexity might best be understood in terms of variation or, more specifically, intensity, contrast and abundance. It parallels Osgood's Activity and is also identified as Activity by Canter, while Berlyne calls it Complexity - Uncertainty.
Variables: composite, lively, motley, subdued.

The degree of Unity of an environment is a matter of how well all the various parts fit together into a coherent and functional unit. The most common name for this factor is probably Coherence, which is used, among others, by Canter.
Variables: consistent, functional, of pure style, whole.

Enclosedness implies a sense of enclosure. This spatial factor is frequently reported and called, for instance, Spatial Quality.
Variables: airy, closed, demarcated, open.

Potency, the impression of inherent power of the environment but also clearly associated with one sex or the other. Same as Osgood's Potency. Berlyne has identified it but calls it Cortical Arousal.
Variables: feminine, fragile, masculine, potent.

Social Status denotes an evaluation of the built environment in socio-economic terms.
Variables: expensive, lavish, simple, well-kept.

Affection implies a kind of recognition, an impression of familiarity - not necessarily because we have been in a particular place before, but perhaps as a result of our biological and cultural inheritance. Berlyne (1971) calls it Familiarity.
Variables: aged, modern, new, timeless.

Originality is an impression of the unusual and surprising in the environment. It might correspond to Berlyne's and to Osgood's Novelty or to names like Ambiguity or Mystery.
Variables: curious, ordinary, special, surprising.

APPENDIX 3: The eleven environmental component descriptive dimensions (Sorte, 1982)

The following interpretations are given by the author (Sorte, 1982).

Valency. The component may have a positive attracting or a negative repulsing effect on the perceiver.

Variables: friendly, personal, boring, unpleasant.

Mass. The components may be more or less massive and strong on one hand or light and airy on the other.

Variables: massive, strong, light, airy.

Form. The perception of the rounded and irregular on one hand or the edgy and symmetrical on the other.

Variables: edgy, symmetric, irregular, rounded.

Articulation. Concerns the degree of finish and decoration surpassing what is absolutely necessary for the function in question.

Variables: decorated, purified, simple, overdone.

Meaning. Correspondence between the components' actual expression and the expectation one has concerning that type of object.

Variables: permanent, real, not well conceived, temporary.

Texture. Whether the component is dominated by smooth and glaring or scratched and rough surfaces.

Variables: shiny, polished, scratched, rough.

Structure. The relationship between the parts of a component. The number of parts, their similarity and the way they are arranged.

Variables: rich in detail, varied, composed, coherent.

Scale. The perception of the relative size of the object.

Variables: small, oversized, dominating, high.

Age. The expression of past or present time.

Variables: new, modern, old-fashioned, used.

Color. The coloristic characteristics of the object and the colorful in contrast to the colorless.

Variables: rich in color, gaily colored, grey, colorless.

Lightness. Concerns on one hand light objects, dark objects on the other.

Variables: dark, drab, light, dusky.

APPENDIX 4: The two personal measures described by the Eysenck Personality Inventory.

The two main dimensions, generated by the EPI are extroversion and neuroticism. David Canter describes these traits in 'Psychology for Architects' (1974) in the following way:

"Extraversion is seen as having its opposite in introversion and although these two ideas do relate to the person's interest in things outside of himself it is tempting for architects to see an immediate relationship to being influenced by the environment or not influenced. The details of the studies show that this is far too simple a description. Besides the fact that we must always remember that we are talking about a person's position along an underlying continuum and are not classifying people into one type or the other, it is also clear from analysis of the questions that extraversion has two distinct subgroups. These relate to the concepts of sociability, the interest in and awareness of other people, gaining enjoyment from parties rather than from books, etc., and another component of impulsivity. The term for this latter aspect expresses it quite aptly, indicating as it does the degree to which a person will act on impulse rather than after detailed, careful consideration."

"Neuroticism has its alternative pole in the concept of normality and is often described as the degree to which a person is emotionally labile. In other words, the degree to which he responds to situations in an emotional way. At the extreme, this leads to the whole range of behaviours which are commonly thought of as neurotic, particularly with regard to worrying about the situation in which the person finds himself or his ability to cope."

APPENDIX 5: The three personal measures described by the Arousal Seeking Tendency test (Mehrabian & Russell, 1974).

This test, originally American, has been translated and adapted to Swedish conditions by Kuller, 1977. Three personal measures were retained:

Arousal by Change describes the individual's need of on one hand to search for renewal and change, on the other to prefer a quiet and tranquil life style.

Arousal by Sensuality focuses mainly on the individual's surrounding and its stimulating effect, more than on the activity one is engaged in. The own home, its decoration, textures, other people and their presence and clothes, noises, winds, stress and changes, all these things can provide stimulation and are thus searched for or avoided.

Arousal by Originality focuses on the original, mysterious and exotic, even foolish and threatening. The individual perceives himself as an exciting person, hunting the unpredictable, or finds his security in a regular and tranquil life style.

APPENDIX 6: The five personal measures described by the
Social Situation form (Kuller, 1978).

The dimensions are here described in relation to the
activation theory model (Kuller, 1976).

Social Intensity seems to be related to social density and
how well the people in a given situation know each other.
Also the type of the social contact, its cause and general
liveliness are important factors. A higher social intensity
will generally cause a higher activation level.

Social Stability reflects the stress in the actual personal
relations. Also stability might affect the activation level
of the social environment since a more negative perception
of the stability in the social relations will increase the
activation level for the individual.

Social Familiarity describes how common or wellknown the
actual social environment is perceived. Familiarity with the
situation might generally decrease the activation level.
Everything new and unknown, independent of its degree of
curiosity or interest, insecurity or fear, will increase the
activation level.

Social Organization will be high if it is aimed, formal and
planned. A high degree of organization will decrease the
activation level. An overorganized situation will hardly be
perceived as activating.

Social Friendliness expresses the evaluation of the personal
relations in the situation in terms of positive, negative or
neutral.

APPENDIX 7: The three personal measures described by the Socio-cultural Attitudes form (Janssens, 1981, 1984).

Political opinion reflects the individual's evaluations in more or less pronounced political terms. On one side of the pole typical left wing evaluations are expressed, such as: more power to the working class, increase of the help to the underdeveloped countries, support to labor unions, collectivism, and so on. The other side reveals conservative political evaluations: free enterprise, too much left wing propaganda in the media, too much power to the unions, even involvement with religion.

Rationality gives a description of the individual's tendency towards a logical, intellectual way of life or a more sensitive, emotive, sometimes superstitious behavior. The dimension describes on one hand a distrust of religious beliefs or values, a preference for urbanism, a belief in strict science and technical development. The other side reveals tendencies towards superstition, belief in eternal life, homeopathic medicines and religious interests.

Social conservatism seems to denote a more general conservative or progressive tendency without being directly related to political opinions. On the one side the individual expresses his trust in old values, e.g., physical punishment of delinquents, liking of sports, disliking of new products, preference for old traditional dishes and so on. On the other side the individual states his belief in less traditional opinions, e.g., decreasing of private motorized transportation, belief in life in outer space, disliking of sports and leisure time as well as disapproval of public tobacco smoking and so on.

APPENDIX 8: The six personal measures described by the
Personal History form (Janssens, 1984).

Basic security is generally defined by the individual's perception of his own background and present situation as happy and friendly. A high social intercourse with kinsfolk and siblings, related to a positive evaluation of the job and negatively with alcohol consumption.

Economic security expresses the individual's perception of his economic situation, both present and future.

Sociability is defined by the individual's amount of social contacts both with working fellows and other friends. The dimension seems to be negatively correlated with the dwelling situation. Shorter stays at one place and disliking of one's own dwelling would increase sociability.

Comfort with one's own dwelling is describing the individual's appreciation of his own dwelling accommodations, both indoor and outdoor environments are perceived as either positive or negative.

Social permanency is highly correlated with the individual's age and permanency in living situation, both in the community and larger region.

Upbringing reflects the individual's perception of his own childhood and youth as either free or strict. The strict upbringing seems to be connected with stronger religious tendencies in the family.

